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INTRODUCTION

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Certain publications abstracted in *STAR* are given analytic treatment, with citations and abstracts of daughter items following immediately after the parent document. When the subject content of a daughter differs from that of its parent, a cross-reference citation is printed at the end of the category to which the daughter would normally have been assigned.

Five indexes are included in each issue: subject, personal author, corporate source, contract number, and report/accession number. Cumulative index volumes are published semiannually and annually.

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IAA is available on subscription from the American Institute of Aeronautics and Astronautics. Technical Information Service, 750 Third Avenue, New York, NY 10017, at the following annual rates:

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Scientific and technical reports produced by NASA and its contractors and grantees, or in conjunction with other Government agencies, and other selected documents released by NASA are identified by an asterisk (*) following the accession numbers (e.g., N72-10748*). Prior to their announcement in *STAR*, these NASA publications are assigned a specific NASA report number, which is shown on the last line of the *STAR* citation. The nature of NASA publications is specified by the report number series, identified by a prefix to the report number: TR-R, TN-D, TM-X, TT-F, CR, or SP. These series refer respectively to NASA Technical Reports, which contain significant and complete contributions to scientific and technical knowledge; Technical Notes, reports of similar quality but lesser scope; Technical Memorandums, reports containing preliminary data or of specialized utility; Technical Translations, information published in a foreign language and considered to merit NASA distribution in English; Contractor Reports, information generated under NASA-sponsored contracts, grants, or interagency agreements; and Special Publications, which include conference proceedings, monographs, data compilations, sourcebooks, special bibliographies, and other publications derived from or of value to NASA activities. Reports in these series that are printed by NASA are often referred to as "low-numbered" or "low series" publications, because the report number is always below 50,000 (8,000 for Technical Translations). Some TM-X and CR reports are numbered above 50,000. These, and TT-F translations above 8,000, are referred to as "high-numbered" or "high series" publications, and are generally available only in microfiche[1] or facsimile reproductions.

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The Preliminary Edition of the *NASA Thesaurus* (December 1967) (NASA SP-7030) is used as the authority for the indexing vocabulary that appears in the subject index. The *NASA Thesaurus* should be consulted in examining the current indexing vocabulary, including associated cross-reference structure. Only the subject terms that have been selected to describe the documents abstracted in this issue appear in the subject index. Copies of the *NASA Thesaurus* may be obtained from the National Technical Information Service or the U.S. Government Printing Office at $8.50 for the three-volume set. The first two volumes of this Thesaurus, consisting of the alphabetical listing of subject terms (A–Z), have been superseded by the following single-volume publication: *NASA Thesaurus Alphabetical Update* (September 1971) (NASA SP-7040), available from NTIS for $6.00. (Volume III of the Preliminary Edition consists of the following ancillary aids to vocabulary selection: heirarchical display of index terms, category term listing, permuted index, and a listing of postable terms only.)

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TABLE OF CONTENTS

Subject Categories

Abstracts in the journal are grouped under the following categories:

page

01 Aerodynamics 2371
Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 32 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

02 Aircraft 2372
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

03 Auxiliary Systems 2379
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

04 Biosciences 2381
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

05 Biotechnology 2385
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

06 Chemistry 2390
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

07 Communications 2393
Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

08 Computers 2398
Includes computer operation and programming, and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

09 Electronic Equipment 2401
Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors, integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

10 Electronics 2403
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

11 Facilities, Research and Support 2405
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

12 Fluid Mechanics 2409
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

13 Geophysics 2415
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

14 Instrumentation and Photography 2425
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders, transducers; aerial photography; and telescopes and cameras.

15 Machine Elements and Processes 2434
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

16 Masers 2443
Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

17 Materials, Metallic 2444
Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

page

18 Materials, Nonmetallic 2449
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

19 Mathematics 2451
Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

20 Meteorology 2454
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

21 Navigation 2460
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

22 Nuclear Engineering 2465
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

23 Physics, General 2466
Includes acoustics, Cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology, and 29 Space Radiation.

24 Physics, Atomic, Molecular, and Nuclear 2470
Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

25 Physics, Plasma 2472
Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

26 Physics, Solid-State 2474
Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

27 Propellants 2477
Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

28 Propulsion Systems 2478
Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

29 Space Radiation 2480
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

30 Space Sciences 2482
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

31 Space Vehicles 2490
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

32 Structural Mechanics 2495
Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

33 Thermodynamics and Combustion 2497
Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

34 General 2499
Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

page

SUBJECT INDEX I-1
PERSONAL AUTHOR INDEX I-47
CORPORATE SOURCE INDEX I-53
CONTRACT NUMBER INDEX I-65
REPORT/ACCESSION NUMBER INDEX ..... I 69

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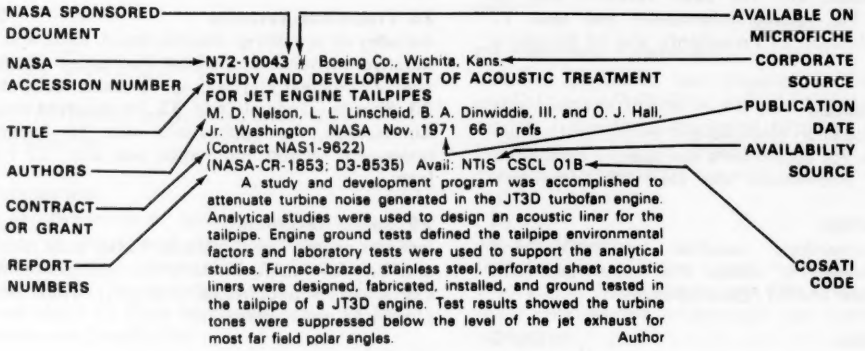
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PUBLICATION DATE
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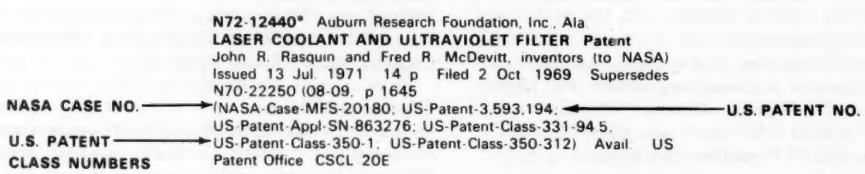
COSATI CODE
N72-10043 # Boeing Co., Wichita, Kans.
STUDY AND DEVELOPMENT OF ACOUSTIC TREATMENT FOR JET ENGINE TAILPIPES
M. D. Nelson, L. L. Linscheid, B. A. Dinwiddie, III, and O. J. Hall, Jr. Washington NASA Nov. 1971 66 p refs
(Contract NAS1-9622)
(NASA-CR-1853; D3-8535) Avail: NTIS CSCL 01B
A study and development program was accomplished to attenuate turbine noise generated in the JT3D turbofan engine. Analytical studies were used to design an acoustic liner for the tailpipe. Engine ground tests defined the tailpipe environmental factors and laboratory tests were used to support the analytical studies. Furnace-brazed, stainless steel, perforated sheet acoustic liners were designed, fabricated, installed, and ground tested in the tailpipe of a JT3D engine. Test results showed the turbine tones were suppressed below the level of the jet exhaust for most far field polar angles. Author

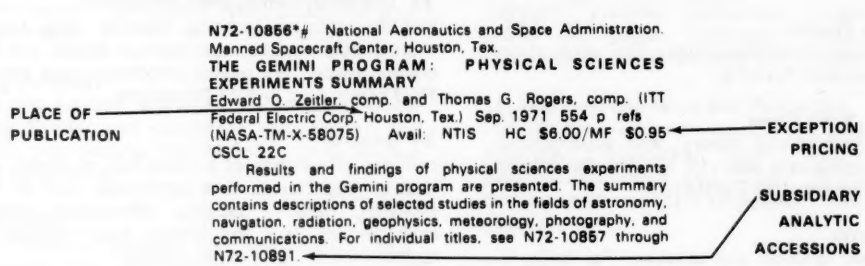
PATENT CITATION


NASA CASE NO.
U.S. PATENT CLASS NUMBERS
U.S. PATENT NO.
N72-12440* Auburn Research Foundation, Inc., Ala
LASER COOLANT AND ULTRAVIOLET FILTER Patent
John R. Rasquin and Fred R. McDevitt, inventors (to NASA) Issued 13 Jul. 1971 14 p Filed 2 Oct. 1969 Supersedes N70-22250 (08-09, p 1645
(NASA-Case-MFS-20180; US-Patent-3,593,194; US-Patent-Appl-SN-863276; US-Patent-Class-331-94.5; US-Patent-Class-350-1; US-Patent-Class-350-312) Avail: US Patent Office CSCL 20E

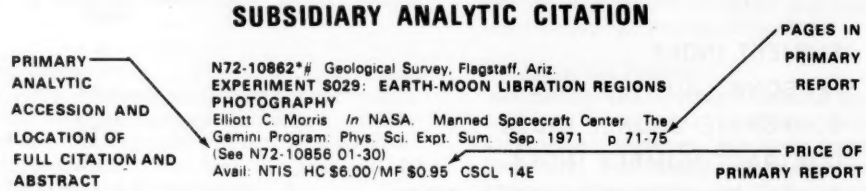
PATENT APPLICATION CITATION

U.S. PATENT APPLICATION SERIAL NO.
N72-10432*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DIATOMIC INFRARED GASDYNAMIC LASER Patent Application
Robert L. McKenzie, inventor (to NASA) Filed 26 Apr. 1971 14 p
(NASA-Case-ARC-10370-1; US-Patent-Appl-SN-137391) Avail: NTIS CSCL 20E

PRIMARY ANALYTIC CITATION AND ABSTRACT


PLACE OF PUBLICATION
EXCEPTION PRICING
SUBSIDIARY ANALYTIC ACCESSIONS
N72-10856*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE GEMINI PROGRAM: PHYSICAL SCIENCES EXPERIMENTS SUMMARY
Edward O. Zeitler, comp. and Thomas G. Rogers, comp. (ITT Federal Electric Corp. Houston, Tex.) Sep. 1971 554 p refs
(NASA-TM-X-58075) Avail: NTIS HC $6.00/MF $0.95 CSCL 22C
Results and findings of physical sciences experiments performed in the Gemini program are presented. The summary contains descriptions of selected studies in the fields of astronomy, navigation, radiation, geophysics, meteorology, photography, and communications. For individual titles, see N72-10857 through N72-10891.

SUBSIDIARY ANALYTIC CITATION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N72-10862*# Geological Survey, Flagstaff, Ariz.
EXPERIMENT S029: EARTH-MOON LIBRATION REGIONS PHOTOGRAPHY
Elliott C. Morris *In* NASA. Manned Spacecraft Center The Gemini Program: Phys. Sci. Expt. Sum. Sep. 1971 p 71-75
(See N72-10856 01-30)
Avail: NTIS HC $6.00/MF $0.95 CSCL 14E

VOLUME 10 NUMBER 18 / SEPTEMBER 23, 1972

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N72-26993 Aeronautical Research Council (England).
TECHNICAL REPORT FOR THE YEAR 1958. VOLUME 1: [RESEARCH ON AERODYNAMICS, AERODYNAMIC HEATING, AND AIRFOILS]
HMSO 1971 718 p refs 3 Vol.
(SBN-11-470151-2) Copyright. Avail: HMSO £17.50; PHI $67.83

A compilation of reports on theoretical aerodynamics for the year 1958 are presented. The subjects discussed are: (1) aerodynamic forces, (2) aerodynamic heating, (3) airfoil design, (4) aircraft performance, (5) boundary layer control, (6) flutter and oscillations, (7) guided weapons systems, (8) meteorology, (9) thermodynamics, and (10) wind tunnels. Extensive references to technical documents which support the findings of the research projects are included. P.N.F.

N72-26994 Aeronautical Research Council (England).
TECHNICAL REPORT FOR THE YEAR 1958. VOLUME 2: [RESEARCH ON AIRCRAFT, BOUNDARY LAYERS, COMPRESSORS AND TURBINES, AND FLUTTER AND OSCILLATIONS]
HMSO 1971 881 p refs 3 Vol.
(SBN-11-470152-0) Copyright. Avail: HMSO £20; PHI $77.52

For abstract, see N72-26993.

N72-26995 Aeronautical Research Council (England).
TECHNICAL REPORT FOR THE YEAR 1958. VOLUME 3: [RESEARCH ON GUIDED WEAPON SYSTEMS, WIND TUNNELS, VTOL, AIRCRAFT, SEAPLANES, AND RELATED AERONAUTICAL TOPICS]
HMSO 1971 1480 p refs 3 Vol.
(SBN-11-470153-9) Copyright. Avail: HMSO £18; PHI $69.77

For abstract, see N72-26993.

N72-26996*# Battelle Memorial Inst., Columbus, Ohio.
INVESTIGATION OF THE APPLICABILITY OF THE FREE-WING PRINCIPLE TO LIGHT, GENERAL AVIATION AIRCRAFT
Richard F. Porter, Ross G. Luce, and Joe H. Brown, Jr. Washington NASA Jun. 1972 120 p refs
(Contract NAS1-10174)
(NASA-CR-2046) Avail: NTIS HC $3.00 CSCL 01A

Gust-alleviation benefits for aircraft employing an unconventional wing, free to pivot about a spanwise axis forward of its aerodynamic center and subject only to aerodynamic pitching moments imposed by lift and drag forces and a trailing-edge control surface are reviewed. Author

N72-26997*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
JET EFFECTS ON THE DRAG OF CONICAL AFTERBODIES AT SUPERSONIC SPEEDS
William B. Compton, III Washington Jul. 1972 49 p refs
(NASA-TN-D-6789; L-8139) Avail: NTIS HC $3.00 CSCL 01A

A parametric investigation has been conducted to determine the jet effects on the boattail drag of nozzles with truncated conical afterbodies. The boattail drag for nozzle configurations with boattail angles of 3 deg, 5 deg, and 10 deg and ratios of boattail length to maximum diameter of 1.0, 0.8, and 0.6 was compared for the jet-off condition and for a wide range of jet pressure ratios. A nozzle configuration with a circular-arc boattail was tested also. The tests were run at Mach numbers of 1.83 and 2.20 with the model at an angle of attack of 0 deg. Author

N72-26998# National Aerospace Lab., Tokyo (Japan).
SOME CONSIDERATIONS ON THE AERODYNAMIC CHARACTERISTICS FOR THE BODY OF A ROCKET WITH BLUNT NOSE
Iwao Kawamoto 1972 38 p refs In JAPANESE; ENGLISH summary
(NAL-TR-266) Avail: NTIS HC $4.00

Wind tunnel tests to determine the aerodynamic characteristics of blunt bodies are described. Emphasis is placed on determining the nature of the bow shock wave formed at supersonic speeds and the properties of the rotational flow around the body. Numerical procedures for determining the pressure distributions for various aerodynamic configurations are presented. Author

N72-26999# National Aerospace Lab., Tokyo (Japan).
AERODYNAMIC DESIGN AND TEST RESULTS OF FRONT FANS
Shoichi Fujii, Hide Nishiwaki, and Mitsuo Gomi Jan. 1972 26 p refs
(NAL-TR-268T) Avail: NTIS HC $3.50

Full scale front fans were designed and tested with satisfactory results. The flow field in passing through the fans was estimated by means of a method called streamline-curvature technique. In the first test program the rotor blade row was without snubbers (part-span shroud) and in the second, with them. A comparison of both experimental data enabled the flow behavior and aerodynamic characteristics to be visualized under these two different inlet conditions. Author

N72-27000# National Aerospace Lab., Tokyo (Japan).
INTERFERENCE BETWEEN WING AND SURFACE OF VELOCITY DISCONTINUITY
Norio Inumaru 1971 64 p refs In JAPANESE; ENGLISH summary
(NAL-TR-254) Avail: NTIS HC $5.25

A study is made on the aerodynamic interference between a wing and the surface of velocity discontinuity in a non-uniform potential flow field. The surface of velocity discontinuity is deformed around the wing which penetrates the surface. A deformation of the surface is theoretically predicted, leading to the conclusion that a sectorial region will be formed on the wing. Formation of the sectorial region is recognized in new experiments and also in many existing experimental data. Both theoretical and experimental analyses are made on the physical roles of the sectorial region. Author

N72-27001*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPHERICAL BALLOON RESPONSE TO THREE-DIMENSIONAL TIME-DEPENDENT FLOWS
George H. Fichtl Washington Jul. 1972 28 p refs
(NASA-TN-D-6829; M-188) Avail: NTIS HC $3.00 CSCL 20D

The concept of the Lagrangian displacement of a balloon is introduced. It is shown that the general balloon response problem is extremely complicated because the wind-forcing functions in the balloon equations of motion are functions of the wind velocity vector and its Eulerian first derivatives evaluated at the location of the balloon. The linear perturbation equations for a spherical balloon are derived by perturbing the components of velocity of the balloon about a terminal velocity state which is in equilibrium with a space-time invariant mean horizontal flow. The atmospheric flow is also perturbed such that the resulting equations can be used to analyze the responses of spherical balloons to three-dimensional time-dependent flows. The wind field is represented in terms of a four-fold Fourier integral that involves three orthogonal wave numbers and a frequency, while the balloon components of velocity are represented as Fourier integrals involving a frequency which, in turn, is a function of the wind field wave numbers and frequency and the unperturbed flow components of velocity. Author

N72-27002*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN EFFICIENT ALGORITHM USING MATRIX METHODS TO SOLVE WIND TUNNEL FORCE-BALANCE EQUATIONS
David L. Smith Washington Aug. 1972 43 p refs
(NASA-TN-D-6860; L-8278) Avail: NTIS HC $3.00 CSCL 20D

An iterative procedure applying matrix methods to accomplish an efficient algorithm for automatic computer reduction of wind-tunnel force-balance data has been developed. Balance equations are expressed in a matrix form that is convenient for storing balance sensitivities and interaction coefficient values for online or offline batch data reduction. The convergence of the iterative values to a unique solution of this system of equations is investigated, and it is shown that for balances which satisfy the criteria discussed, this type of solution does occur. Methods for making sensitivity adjustments and initial load effect considerations in wind-tunnel applications are also discussed, and the logic for determining the convergence accuracy limits for the iterative solution is given. This more efficient data reduction program is compared with the technique presently in use at the NASA Langley Research Center, and computational times on the order of one-third or less are demonstrated by use of this new program. Author

N72-27003# Joint Publications Research Service, Arlington, Va.
ON THE SHAPE OF BODIES BEING DESTROYED BY INTENSIVE HEATING DURING MOTION IN THE ATMOSPHERE
I. N. Murzinov 5 Jul. 1972 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. (Moscow), no. 4, 1965 p 36-40
(JPRS-56424) Avail: NTIS HC $3.00

The motion of bodies in the atmosphere at high velocities under conditions of intensive nonstationary heat exchange and the alteration of their shape are discussed. An approximate statement of the problem and its analytical solution are presented. The solution is valid for the frontal surface of bodies on which the pressure distribution is satisfactorily described by Newtonian theory. Also included are examples for calculating the change of the initial spherical shape of a body under conditions of laminar and turbulent heat exchange. Author

N72-27004# Cambridge Univ. (England). Dept. of Engineering.
PRESSURE DISTRIBUTIONS AT M SUB INFINITY = 3.51 AND AT HIGH INCIDENCES ON FOUR WINGS WITH DELTA PLANFORM
R. Hillier London Aeron. Res. Council 1972 34 p refs Supersedes ARC-32828 Sponsored by Sci. Res. Council
(ARC-CP-1198) Avail: NTIS HC $3.75; HMSO 55p; PHI $2.35

Results are presented for wind tunnel tests at 3.51 M on four wings with pointed vertices and sharp leading edges. Two conical models were tested through a wide range of angles of incidence and yaw and the results clearly demonstrate the stabilizing effect of dihedral. Two simple non-conical wings were also tested and it is shown, in this case, that the pressure on the compression surfaces may be approximately deduced from an equivalent conical wing. Author (ESRO)

N72-27005# Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE INFLUENCE OF THE MAGNUS MOMENT ON THE DYNAMIC STABILITY OF A PROJECTILE
Anders S. Platou Jan. 1972 19 p refs
(AD-738016; BRL-MR-2155) Avail: NTIS CSCL 19/1

The dynamic stability of a projectile is evaluated based on the range of values normally associated with the influencing parameters. The effect of each parameter is demonstrated and it is seen that the pitch damping moment, the transverse radius of gyration and the Magnus moment have the largest influence on the dynamic stability. Author (GRA)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N72-27006 Rensselaer Polytechnic Inst., Troy, N.Y.
EFFECT OF FORWARD SPEED ON A TWO-DIMENSIONAL PERIPHERAL-JET GROUND EFFECT SUPPORT Ph.D. Thesis
George Cunkle Cooke, IV 1971 210 p
Avail: Univ. Microfilms Order No. 72-1182

A theory for the effect of forward speed on a two dimensional peripheral jet ground effect support is presented. New analytical models are proposed for the flow at the nozzle exit of the peripheral jets and the cross flow underneath the support. The analysis is carried to the point of determining upper and lower surface pressure distributions as well as lift and ideal pumping power. The theory is supported by the results of a comprehensive experimental study conducted with a two dimensional model in a moving ground wind tunnel. At low subcritical speeds the effect of forward speed was found to be adverse in the absence of upper surface lift. At high subcritical speeds performance improved such that lift power requirements at critical speeds were 20-30% below those at hover.
Dissert. Abstr.

N72-27007 Purdue Univ., Lafayette, Ind.
AN INVESTIGATION OF THE EFFECTS OF STOL AIRCRAFT OPERATING FROM CONGESTED MAJOR AIRPORTS Ph.D. Thesis
James Paul Ditz 1971 195 p
Avail: Univ. Microfilms Order No. 72-1848

Changes in aircraft congestion at major airports due to the introduction of short takeoff and landing (STOL) aircraft into the system of airlines operating from the major airport are evaluated. The STOL aircraft are assumed to operate from a STOL runway at the major airport. An approximation of the number and the schedules of conventional takeoff and landing aircraft with and without STOL aircraft in the system is obtained. An approximate transient M/D/1 queueing model is formulated to calculate aircraft delay times and imposed waiting times. The minimization of the objective function requires prior knowledge of the resulting arrival rates of aircraft at the landing and takeoff queues. Therefore, an iterative procedure is developed which modifies the input arrival rates so they converge approximately to the output rates. Dissert. Abstr.

N72-27008* National Aeronautics and Space Administration, Washington, D.C.
ENVIRONMENTAL STATEMENT FOR EARTH RESOURCES AIRCRAFT PROGRAM Draft Environmental Impact Statement
Mar. 1971 6 p
(NASA-TM-X-68550) Avail: NASA Public Document Rooms, $1.00 CSCL 01B

An environmental impact statement for the Earth Resources Aircraft program is submitted. The program objectives are summarized and the benefits are described. It is concluded that the air pollution resulting from the operation of four aircraft in the program cannot create a significant amount of environmental degradation. The adverse effects which cannot be avoided amount to the operation of the aircraft which meet the established criteria for operational aircraft. Author

N72-27009 National Lending Library for Science and Technology, Boston Spa (England).
THE DYNAMICS OF THE HIGH ATMOSPHERIC AND SUPERSONIC FLIGHT
C. Dousset and R. Joatton [1972] 11 p Transl. into ENGLISH from proceedings of French/Am. Meteorol. Soc. Joint Meeting, 1971
(NLL-M-22437-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The effects of atmospheric turbulence at high altitudes on the operation of supersonic transport aircraft is discussed. The characteristics of atmospheric turbulence under various conditions are described. Methods for advance detecting atmospheric turbulence are examined. It is concluded that the horizontal temperature gradient is the best known physical correlation which permits advance detection of clear air turbulence. The operational characteristics of the Concorde aircraft are used as examples of supersonic transport limitation under turbulent conditions. Author

N72-27010*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TERMINAL-AREA FLIGHT PROCEDURES AND ROUTE DESIGN FOR SUPERSONIC TRANSPORT NEW YORK-TRANSATLANTIC OPERATIONS
Richard H. Sawyer and Milton D. McLaughlin Washington May 1972 36 p refs
(NASA-TN-D-6801; L-8283) Avail: NTIS HC $3.00 CSCL 01B

The results of an analytical investigation of two departure and arrival transition procedures between John F. Kennedy International Airport and projected North Atlantic track systems for supersonic transport (SST) operations are presented. The procedures studied were: (1) separated departure and arrival transition routes with departures made at supersonic speeds, and (2) superimposed departure and arrival routes with departures restricted to subsonic speed until the airplane is on the track system. For both procedures, transition routes with intercept angles of 30 deg to 90 deg to both six-and four-track systems were investigated. Track spacings of 30 and 60 nautical miles were studied. Author

N72-27011# Civil Aeromedical Inst., Oklahoma City, Okla.
CRASH SURVIVAL ANALYSIS OF 16 AGRICULTURAL AIRCRAFT ACCIDENTS
J. J. Swearingen, T. F. Wallace, J. G. Blethrow, and D. E. Rowlan Apr. 1972 27 p refs
(FAA Proj. AM-A-72-PRS-37; FAA Proj. AM-A-71-PRS-37)
(FAA-AM-72-15) Avail: NTIS HC $3.50

Findings from on-the-scene investigations to evaluate the crashworthiness of the present fleet of agricultural applicator aircraft are presented. A detailed presentation of 16 crashes illustrates the fact that most of these specialized aircraft structures are well designed to protect the pilot, even in severe crashes. Most injuries and deaths of aerial applicator pilots are not attributable to failure of the cockpit structure itself, but rather to factors associated with (1) pilot restraint equipment, (2) seat failures, (3) failure of the roll-over structure, and (4) a lack of head impact attenuators at the top of the instrument panel. Author

N72-27012*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOISE GENERATED BY STOL CORE-JET THRUST REVERSERS
James R. Stone and Orlando A. Gutierrez 1972 17 p refs Presented at Aircraft Design, Flight Test, and Operations Meeting, Los Angeles, 7-9 Aug. 1972; sponsored by AIAA
(NASA-TM-X-68082; E-6975) Avail: NTIS HC $3.00 CSCL 01B

An experimental investigation on the noise generated by target-type thrust reversers is discussed. The experimental data are normalized and scaled up to sizes suitable for reversing the core jets of a 100,000 lb augmentor-wing-type STOL airplane. The scaling calculations yield perceived noise levels well above the 95-PNdB design goal for both sideline and flyover at 500 ft. V-gutter and semicylindrical reversers were tested with a 5.24-cm-diameter circular nozzle, and a semicylindrical reverser was also tested with a 7.78-cm-diameter circular nozzle. The thrust reversers, in addition to being noisier than the nozzle alone, also had a more uniform directivity. The maximum overall sound pressure level and the effective sound power level both varied with sixth power of the nozzle jet velocity. Author

N72-27013*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
STATISTICAL SURVEY OF XB-70 AIRPLANE RESPONSES AND CONTROL USAGE WITH AN ILLUSTRATION OF THE APPLICATION TO HANDLING QUALITIES CRITERIA
Bruce G. Powers Washington Jul. 1972 40 p refs
(NASA-TN-D-6872; H-663) Avail: NTIS HC $3.00 CSCL 01B

The magnitude and frequency of occurrence of aircraft responses and control inputs during 27 flights of the XB-70 airplane were measured. Exceedance curves are presented for the airplane responses and control usage. A technique is presented which makes use of these exceedance curves to establish or verify handling qualities criteria. This technique can provide a means of incorporating current operational experience in handling qualities requirements for future aircraft. Author

N72-27014*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL EVALUATION OF A TF30-P-3 TURBOFAN ENGINE IN AN ALTITUDE FACILITY: AFTERBURNER PERFORMANCE AND ENGINE-AFTERBURNER OPERATING LIMITS
John E. McAulay and Mahmood Abdelwahab Washington Jul. 1972 35 p refs

(NASA-TN-D-6839; E-6833) Avail: NTIS HC $3.00 CSCL 21E

For distortion free steady state operation at the maximum (full afterburning) throttle position, the afterburner combustion efficiency decreased from 0.91 to 0.68 as engine inlet Reynolds number index was reduced from 0.80 to 0.25. Engine afterburner operational limits were obtained for transient and fixed throttle operation over a range of engine inlet distortions. At limiting conditions, time histories of pressures in the fan compressor during throttle transients between military and maximum showed the development of rotating stall in the fan hub which quickly propagated and produced complete stall in the high pressure compressor. Author

N72-27015*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

TRANSONIC TRANSPORT STUDY: ECONOMICS

Cynthia L. Smith and Darrell E. Wilcox Washington May 1972 27 p refs

(NASA-TM-X-62159) Avail: NTIS HC $3.50 CSCL 01B

An economic analysis was performed to evaluate the impact of advanced materials, increased aerodynamic and structural efficiencies, and cruise speed on advanced transport aircraft designed for cruise Mach numbers of .90, .98, and 1.15. A detailed weight statement was generated by an aircraft synthesis computer program called TRANSYN-TST; these weights were used to estimate the cost to develop and manufacture a fleet of aircraft of each configuration. The direct and indirect operating costs were estimated for each aircraft, and an average return on investment was calculated for various operating conditions. There was very little difference between the operating economics of the aircraft designed for Mach numbers .90 and .98. The Mach number 1.15 aircraft was economically marginal in comparison but showed significant improvements with the application of carbon/epoxy structural material. However, the Mach .90 and Mach .98 aircraft are the most economically attractive vehicles in the study. Author

N72-27016# Advisory Group for Aerospace Research and Development, Paris (France).

AIRFRAME/ENGINE INTEGRATION

A. Ferri May 1972 197 p refs

(AGARD-LS-53) Avail: NTIS HC $12.00

Analytical and experimental methods for investigating interference problems in airplane design optimization are reported. Considered are inlet-airplane interference, nozzle geometry and exhaust jet-airplane interference dynamics of engine and airplane characteristics. For individual titles, see N72-27017 through N72-27023.

N72-27017 New York Univ., N.Y.

ENGINE AIRPLANE INTERFERENCE DEFINITION OF THE PROBLEM AND RELATED BASIC FLUID DYNAMIC PHENOMENA

Antonio Ferri *In* AGARD Airframe/Engine Integration May 1972 12 p refs (For availability see N72-27016 18-02)

The lack of simulation of the engine flow introduces substantial differences between the aerodynamics of the actual airplane and of the model tested. Characteristics related to the interference between an airplane and the engine, and their effects on the calculated performance of the airplane are integrated into analog and digital simulation, where the wind tunnel or test stand provides analog data, to improve the results. G.G.

N72-27018 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

INLET/AIRPLANE INTERFERENCE AND INTEGRATION

Philip P. Antonatos, Lewis E. Surber, and Donald J. Stava *In* AGARD Airframe/Engine Integration May 1972 54 p refs (For availability see N72-27016 18-02)

The basic technological problems and potential solutions relating to the development of inlet and airframe design criteria are discussed. Results of analytical and experimental work emphasize details of closely coupled inlet airframe concepts. Inlet flow fields generated by basic forebody and forebody/wing combinations are reviewed together with an anlysis of the effects of variations in fuselage shape, forebody camber, wing geometry and inlet position. Problems associated with boundary layer development and vortex ingestion are discussed in terms of their effect on inlet design. Attitude effects such as angle of attack and angle of yaw are reviewed. The losses due to spillage, bleed and bypass flows are analyzed as they affect vehicle performance. Criteria are reviewed to minimize such loss for the development of optimal inlet/airframe performance. Specific problems relating to the subsonic-transonic flight regime and the supersonic regime are included. Author

N72-27019 Aircraft Research Association, Ltd., Bedford (England).

EXPERIMENTAL DETERMINATION OF INLET CHARACTERISTICS AND INLET AND AIRFRAME INTERFERENCE

E. C. Carter *In* AGARD Airframe/Engine Integration May 1972 24 p refs (For availability see N72-27016 18-02)

The following experimental methods are considered: Measurement of the interference of the inlet on the airframe, measurement of the interference of the airframe on the inlet, and measurement of the performance of the inlet/airframe combination as a whole. The use of complete aerodynamic force models and partial models is discussed including the drag use of full and half model tunnel techniques. Particular attention is given to drag. Shortcomings of the present techniques are pointed out and alternative proposals are made where possible. Author

N72-27020 Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).

NOZZLE/AIRFRAME INTERFERENCE AND INTEGRATION

Felix Aulehla and Kurt Loter *In* AGARD Airframe/Engine Integration May 1972 25 p refs (For availability see N72-27016 18-02)

The main parameters involved in the interference between internal and external flow are discussed. Also considered is how these parameters in principle affect afterbody drag. Then the definition of rear end drag is given in the conventional way and also in a more relative manner approaching the physical optimum. For configurations with single and twin engines installed in the rear end of the fuselage wind tunnel test results for various nozzle concepts are presented and discussed. The geometric variations in these tests comprise boattail angle, size and location of the base, nozzle interfairings and engine spacing. Proper consideration of these geometric parameters in nozzle/airframe integration, reduces additional afterbody drag drastically in the transonic flight regime. Author

N72-27021 National Aerospace Lab., Amsterdam (Netherlands).

EXPERIMENTAL DETERMINATION OF NOZZLE CHARACTERISTICS AND NOZZLE AIRFRAME INTERFERENCE

c12

F. Jaarsma *In* AGARD Airframe/Engine Integration May 1972 45 p refs (For availability see N72-27016 18-02)

An outline is given under which circumstances certain jet flow and nozzle parameters should be simulated in the wind tunnel for both installed thrust and drag determination. The circumstances relate to the flight regimes, nozzle types and engine installation configurations. Next the technical requirements for the wind tunnel and the model are given and the difficulties in fulfilling these requirements are discussed. The techniques and schemes as used by the various groups in the AGARD countries are reviewed. Special attention is given to miniature turbo engine simulators. Author

N72-27022 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

DYNAMIC CHARACTERISTICS OF ENGINE INLETS

Demetrius Zonars *In* AGARD Airframe/Engine Integration

May 1972 16 p refs (For availability see N72-27016 18-02)

Inlet random pressure fluctuations and their effects on reducing the stall margin of turbojet engines are discussed. A review is accomplished of the TF-30/F-111 compatibility study over the past several years. The practicality of utilizing steady state and instantaneous distortion factors to determine inlet-engine compatibility is assessed and recent advances in inlet research configurations with associated steady state and dyñamic distortions are presented. Finally, a complete random data acquisition, editing, and processing method is developed for accomplishing data analysis as an inlet diagnostic tool. Author

N72-27023 Naval Postgraduate School, Monterey, Calif.
ENGINE INTEGRATION AND THRUST/DRAG DEFINITION
Allen E. Fuhs *In* AGARD Airframe/Engine Integration May 1972 21 p refs (For availability see N72-27016 18-02)

Various definitions relating to thrust and drag are considered. Since thrust minus drag is of primary interest, the background on drag determination is discussed. This is followed by testing techniques for full scale propulsion systems. Sources of installation losses are of considerable interest. Several different methods have evolved to account for various terms in a drag/thrust determination. Bookkeeping of forces and momentum flux is described. Any aircraft development is controlled by schedules and fixed resources. Influence of these constraints on engine-airframe integration is discussed. Some special integration problems, e.g., engine bleed air, are considered. Author

N72-27024*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SIMPLIFIED METHODS FOR INTERPRETING THE EFFECT OF TRANSFER-FUNCTION ZEROS ON THE TRANSIENT RESPONSE OF AIRCRAFT
Reiner Onken Washington Jul. 1972 44 p refs
(NASA-TM-X-2585; A-4180) Avail: NTIS HC $3.00 CSCL 01B

Two simple methods are outlined for evaluating the effect of transfer-function zeros on the system time response. The pole effects can also be evaluated. These methods are useful for simplified analysis or creating design criteria in terms of desirable regions of pole-zero locations. The type of transfer function studied is limited to those linear systems. Corresponding to ordinary longitudinal or lateral aircraft transfer functions, the denominator polynomial is of fourth order and the numerator of third order at most. With the longitudinal motion of the aircraft as an example, the methods are used in the evaluation of optimal regulator control with respect to a particular performance index structure. Author

N72-27025# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
AIRCRAFT ACCIDENT REPORT: AMERICAN AIRLINES, INCORPORATED, BOEING 707-323, N7595A AND A LINDEN FLIGHT SERVICE, INCORPORATED, CESSNA 150, N60942 OVER EDISON, NEW JERSEY, 9 JANUARY 1971
10 May 1972 17 p
(NTSB-AAR-72-16) Avail: NTIS HC $3.00

An aircraft accident involving the collision between a Boeing 707 and a Cessna 150 on 9 January, 1971 near Edison, New Jersey is reported. The probable cause of the accident was the inability of the crews of both aircraft to see and avoid each other while operating in a system which permits VFR aircraft to operate up to 3,000 feet on random headings and altitudes in a congested area under conditions of reduced visibility. Other factors were the deviation of the air carrier aircraft from its clearance altitude and conducting student flight training in a congested control area under marginal flight visibility conditions. Author

N72-27026# National Aerospace Lab., Tokyo (Japan).
AN ANALYTICAL METHOD TO PREDICT HEIGHT-VELOCITY DIAGRAM AND CRITICAL DECISION POINT OF ROTORCRAFT
Mesaki Komoda Aug. 1971 65 p refs In JAPANESE; ENGLISH summary
(NAL-TR-245) Avail: NTIS HC $5.25

An analytical method utilizing optimization techniques to estimate height-velocity diagram and the critical decision point of rotorcraft is proposed. It is pointed out that the control inputs of the pilot to the system equations describing rotorcraft dynamics are obtained as the solution of an adequately stated optimization problem, in which the final rotor rpm is maximized, or equivalently, the height loss is minimized or maximized. It is also shown that the degree of optimality of controls can be evaluated by means of impulsive response function associated with the optimal trajectories thus obtained. In order to show the applicability of this approach, sample calculations are presented for high hover point, knee point and for low hover point of height-velocity boundary, as well as for a partial power climb and a rejected take-off from critical decision point. State equations which are linearized with respect to acceleration factors at G.G. are used for simplicity. A comparison with FAA flight test data as to the high hover point is included. Author

N72-27027# National Aerospace Lab., Tokyo (Japan).
OVERALL GROUND EXPERIMENTS ON FLYING TEST BED FOR VTOL AIRCRAFT AT NATIONAL AEROSPACE LABORATORY
Naoto Takizawa, Yoshikazu Tanabe, Akiyoshi Shibuya, Toshio Ogawa, Hirotoshi Fujieda, Tadao Kai, Hiroshi Nishimura, Koichi Ono, and Yoshio Goto Feb. 1972 93 p refs In JAPANESE; ENGLISH summary
(NAL-TR-276) Avail: NTIS HC $6.75

The overall ground experiments on the flying test bed which has been developed for the purpose of studying the problems associated with hovering, vertical take-off and landing of VTOL aircraft are described. The experiments were made on the complete assembly but without engines and fuel, and consisted of three items; (1) the functional performance of several subsystems, (2) the capability of the attitude control, and (3) the vibration characteristics of the framework. The subsystems tested were the air turbine system connected with the electrical and hydraulic systems, the bleed air distribution system, the attitude control system, the airborne instrumentation system, and the redundant back-up system. The attitude control experiments made with varying amounts of artificial damping and stabilization showed that their optimum ranges in pitch and roll were revealed independently. In the vibration tests, the measurements covered natural frequencies, modes, damping ratios and phases of vibration of the framework. Author

N72-27028# National Aerospace Lab., Tokyo (Japan).
ON THE AERODYNAMIC DAMPING MOMENT IN PITCH OF A RIGID HELICOPTER ROTOR IN HOVERING
Kingo Takasawa Nov. 1971 82 p refs In JAPANESE; ENGLISH summary
(NAL-TR-256) Avail: NTIS HC $6.25

The aerodynamic damping moment in pitch (ADMP) was measured with a hovering model helicopter rotor. Three kinds of model blades with different rigidity were tried. A flow visualization study was performed for the purpose of determining the relative position between the blade and the vortices in steady hovering state. Using the Rayleigh-Ritz method, the ADMP of the perfectly rigid rotor was determined from the above-mentioned experimental data. A quasi-steady theory is devised. The model based on this theory takes into account: (1) the steady lift loss due to the finite span effect, (2) the steady lift loss attributable to the downwash induced by the returning wake, and (3) the lift variation due to the change of relative position between the blade and the trailing vortices in the returning wake. Author

N72-27029*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FORWARD FLIGHT EFFECTS ON MIXER NOZZLE DESIGN AND NOISE CONSIDERATIONS FOR STOL EXTERNALLY

BLOWN FLAP SYSTEMS
U. vonGlahn, N. Sekas, D. Groesbeck, and R. G. Huff 1972 14 p refs Presented at the 4th Aircraft Design Flight Test and Oper. Meeting, Los Angeles, 7-9 Aug. 1972; sponsored by AIAA
(NASA-TM-X-68102; E-7028) Avail: NTIS HC $3.00 CSCL 01B

Experimental data of the peak axial-velocity decay in a moving airstream are presented for several types of nozzles. The nozzles include a six-tube mixer nozzle of a type considered for reduction of jet-flap interaction noise for externally-blown-flap STOL aircraft. The effect of secondary flow on the core flow velocity decay of a bypass nozzle is also discussed. Tentative correlation equations are suggested for the configurations evaluated. Recommendations for minimizing forward velocity effects on velocity decay and jet-flap interaction noise are made. Author

N72-27030*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY NOISE TESTS OF THE ENGINE-OVER-THE-WING CONCEPT. 2: 10 DEG - 20 DEG FLAP POSITION
Meyer Reshotko, William A. Olsen, and Robert G. Dorsch Jun. 1972 39 p refs
(NASA-TM-X-68104; E-7038) Avail: NTIS HC $4.00 CSCL 01B

Preliminary acoustic tests of the engine-over-the-wing concept as a method for reducing the aerodynamic noise created by conventional and short takeoff aircraft are discussed. Tests were conducted with a small wing section model having two flaps which can be set for either the landing or takeoff positions. Data was acquired with the flaps set at 10 degrees and 20 degrees for takeoff and 30 and 60 degrees for landing. The engine exhaust was simulated by an air jet from a convergent nozzle. Far field noise data are presented for nominal pressure ratios of 1.25, 1.4 and 1.7 for both the flyover and sideline modes. Author

N72-27031*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMPARISON OF WIND TUNNEL AND FLYOVER NOISE MEASUREMENTS OF THE YOV-10A STOL AIRCRAFT
Adolph Atencio, Jr. and Paul T. Soderman Jun. 1972 28 p refs Sponsored in part by Army Air Mobility Res. and Develop. Lab.
(NASA-TM-X-62166) Avail: NTIS HC $3.50 CSCL 01B

The YOV-10A Research Aircraft was flown to obtain flyover noise data that could be compared to noise data measured in the 40- by 80- foot wind tunnel at NASA Ames Research Center. The flyover noise measurements were made during the early morning hours on runway 32L at Moffett Field, California. A number of passes were made at 50 ft altitude in level flight with an airplane configuration closely matching that tested in the wind tunnel. Two passes were selected as prime and were designated for full data reduction. The YOV-10A was flown over a microphone field geometrically similar to the microphone array set up in the wind tunnel. An acoustic center was chosen as a matching point for the data. Data from the wind tunnel and flyover were reduced and appropiate corrections were applied to compare the data. Results show that wind tunnel and flight test acoustic data agreed closely. Author

N72-27032*# Systems Technology, Inc., Hawthorne, Calif.
EXPERIMENTAL MEASUREMENTS OF MOTION CUE EFFECTS ON STOL APPROACH TASKS
Robert F. Ringland and Robert L. Stapleford Apr. 1972 120 p refs
(Contract NAS2-6433)
(NASA-CR-114458; TR-1014-2) Avail: NTIS HC $8.00 CSCL 01B

An experimental program to investigate the effects of motion cues on STOL approach is presented. The simulator used was the Six-Degrees-of-Freedom Motion Simulator (S.01) at Ames Research Center of NASA which has ±2.7 m travel longitudinally and laterally and ±2.5 m travel vertically. Three major experiments, characterized as tracking tasks, were conducted under fixed and moving base conditions: (1) A simulated IFR approach of the Augmentor Wing Jet STOL Research Aircraft (AWJSRA), (2) a simulated VFR task with the same aircraft, and (3) a single-axis task having only linear acceleration as the motion cue. Tracking performance was measured in terms of the variances of several motion variables, pilot vehicle describing functions, and pilot commentary. Author

N72-27033*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUMMARY OF DESIGN CONSIDERATIONS FOR AIRPLANE SPIN-RECOVERY PARACHUTE SYSTEMS
Sanger M. Burk, Jr. Washington Aug. 1972 55 p refs
(NASA-TN-D-6866; L-8219) Avail: NTIS HC $3.00 CSCL 01B

A compilation of design considerations applicable to spin-recovery parachute systems for military airplanes has been made so that the information will be readily available to persons responsible for the design of such systems. This information was obtained from a study of available documents and from discussions with persons in both government and industry experienced in parachute technology, full-scale and model spin testing, and related systems. Author

N72-27034# Technische Univ., Berlin (West Germany). Inst. fuer Flugfuehrung und Luftverkehr.
THE INFLUENCE OF A DISPLAY ON THE HUMAN TRANSFER FUNCTION MEASURED BY MEANS OF AN ADAPTIVE ANALOG PILOT [DER EINFLUSS EIN ER VORANZEIGE AUF DAS MENSCHLICHE UEBERTRAGUNGSVERHALTEN GEMESSEN MIT HILFE EINES ADAPTIVEN ANALOG-PILOTEN]
Dieter Dey Oct. 1971 100 p refs In GERMAN Sponsored by Landesamt fuer Forsch. Nordrhein-Westfalen and Fraunhofer-Ges.
(Rept-64) Avail: NTIS HC $7.00

A model for man transfer function is used to improve the anthropotechnical control system by introducing advanced information, assuming the possibility to describe the man transfer function. A survey is presented of present knowledge of man as part of a control circuit and the control capacity of pilots, assuming the possibility to describe the mean transfer function. An application oriented model is used. This model and a model adaptation process are used for the first time in closed circuit. Advantages and disadvantages of continuous adaptation are evaluated and the results, power density spectra calculated by a Fourier transformation, are discussed. The experimental technique presented was applied to two tested persons, one of which had the benefit of the advanced information signals. Statistical analysis of the results show that advanced information increases the pilot's performance and decreases the response time. In addition it was noted that noise was eliminated in the man-machine system. ESRO

N72-27035# Laboratorium fur Betriebsfestigkeit, Darmstadt (West Germany).
STATISTICAL ANALYSIS OF MISSION PROFILE PARAMETERS OF TRANSPORT AIRCRAFT [STATISTISCHE AUSWERTUNG VON PARAMETERN FUER EINSATZPROFILE VON TRANSPORTFLUGZEUGEN]
O. Buxbaum and P. Reinhold Jul. 1971 45 p refs In GERMAN Sponsored by Bundesmin. der Verteidigung
(TB-88) Avail: NTIS HC $4.25

The cumulative frequency distributions of mission-profile parameters of different types of transport airplanes are shown: flight-time, airplane take-off weight, airplane landing weight, and fuel weights during take-off and landing. Results are presented for jet-powered short, medium, and long range airplanes flown in passenger and cargo service and it is shown that they can be used for the design of other, similar airplanes. ESRO

N72-27036# Naval Air Development Center, Johnsville, Pa.
ARRESTED LANDING FATIGUE TEST OF MODEL C-2A AIRPLANE Final Report
Edward F. Kautz 30 Jun. 1971 42 p refs
(AD-739331; NADC-ST-7111) Avail: NTIS CSCL 01/3

A laboratory fatigue test was performed on a C-2A airframe to determine whether the airframe could sustain the effects of 3000 arrested landings. A total of 6000 arrested landing cycles were applied to the airframe during the test with no structural failures. With a test scatter factor of 2, the 6000 test cycles are equivalent to 3000 service arrested landings. Author (GRA)

N72-27037# Hughes Aircraft Co., Culver City, Calif. Electronic Properties Information Center.
AIRCRAFT STRUCTURAL ELECTRICAL BONDING AND GROUNDING INCLUDING LIGHTNING EFFECTS AND ELECTROSTATIC CHARGE BUILDUP ON MISSILES AND SPACE VEHICLES Interim Report
Feb. 1972 20 p refs
(Contract DSA900-72-C-1182)
(AD-739356; EPIC-IR-74-Rev) Avail: NTIS CSCL 01/2

Over 130 references are provided on static electrification, grounding, electrical bonding and lightning protection. Bonding and grounding of electronic equipment are discussed.
Author (GRA)

N72-27038# Naval Air Development Center, Johnsville, Pa. Vehicle Technology Dept.
FLIGHT LOADS DATA FROM LAMPS HH-2D HELICOPTERS DV/98 OPERATIONS Final Report
David J. Rhoads 18 Feb. 1972 73 p ref
(AD-738452; NADC-72022-VT) Avail: NTIS CSCL 01/3

6A flight loads study was performed on two LAMPS HH-2D helicopters during DV/98 operations to define the flight profiles for the aircraft during fleet operations. The study was made to supplement engineering data for the structural evaluation of the H-2 helicopter used in the LAMPS program. Author (GRA)

N72-27039# Northrop Corp., Hawthorne, Calif. Aircraft Div.
VALIDATION OF THE FLYING QUALITIES REQUIREMENTS OF MIL-F-8785B (ASG) Final Report
Robert N. Kandalaft Sep. 1971 442 p refs
(Contract F33615-71-C-1065; AF Proj. 8219)
(AD-738625; NOR-71-127; AFFDL-TR-71-134) Avail: NTIS CSCL 01/1

A study was conducted to validate the 1969 military specification MIL-F-8785B(ASG), "Flying Qualities of Piloted Airplanes," by performing a detailed comparison of its requirements with the known characteristics of the Northrop F-5 fighter and pilot comments on them. The comparison was based primarily on existing flight test data supplemented by analytical data. Validations or discrepancies are noted, resolutions are attempted if necessary, and recommendations are given. Recommendations are also made for experimental and analytical investigations beyond the scope of this study which will further validate and update the requirements. GRA

N72-27040# Douglas Aircraft Co., Inc., Long Beach, Calif.
DEVELOPMENT OF A GRAPHITE HORIZONTAL STABILIZER Semiannual Interim Technical Report, 1 May - 31 Oct. 1971
George M. Lehman Feb. 1972 234 p refs
(Contract N00156-70-C-1321)
(AD-738900; MDC-J5317; IR-4) Avail: NTIS CSCL 01/3

The structural weights, stress-analysis results, and manufacturing methods are summarized for an A4 aircraft horizontal stabilizer utilizing Narmco 5206 graphite-epoxy laminates in the primary structure. The actual weight of the first unit produced was 178 pounds, a weight reduction of 30% in comparison to the equivalent metal structure. The finished structure weight was comprised of approximately 62 percent graphite-epoxy, 11 percent fiberglass-epoxy, 10, 8, and 5 percent, respectively of aluminum, steel, and titanium alloys (including attachments), and 4 percent adhesive and epoxy fillets. Results of a discrete element stress-analysis are presented for the three critical load conditions on the stabilizer.
Author (GRA)

N72-27041# Directorate of Aerospace Safety, Norton AFB, Calif.
USAF BIRD STRIKE SUMMARY Statistical Report, 1 Jan. - 31 Dec. 1971
31 Dec. 1971 23 p refs
(AD-739464) Avail: NTIS CSCL 01/2

The document is a statistical report of USAF aircraft damaged by collisions with birds during 1971. There were 383 such occurrences which were 23 more than in 1970. In fact, there were more bird strikes in 1971 than during any previous year. Two of these collisions resulted in major accidents. Two crew members were killed in one of these accidents while in the other, two crew members successfully ejected. As in 1970, windscreen/canopy penetrations continue to be the greatest hazard to aircrews. As has been the case in previous years, a substantial number of birds were ingested by engines. Twenty-six percent of the strikes directly involved engines. Author (GRA)

N72-27042# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
FOG DISSIPATION TECHNIQUES FOR EMERGENCY USE
David H. Dickson and James R. Oden Jan. 1972 43 p refs
(DA Proj. 1T0-62111-A-126)
(AD-739487; ECOM-5420) Avail: NTIS CSCL 01/2

The report documents the lesson plan for a short course of instruction in fog dissipation by helicopter, prepared at the request of the U. S. Army Aviation School, Ft. Rucker, Alabama.
GRA

N72-27043# Texas A&M Univ., College Station. Dept. of Industrial Engineering.
CRITERIA FOR EVALUATING THE APPLICABILITY OF COMPOSITE MATERIAL SHAFTS TO HELICOPTER DRIVE SYSTEMS M.S. Thesis
Victor W. Welner May 1971 42 p refs Sponsored by Army
(AD-739429) Avail: NTIS CSCL 01/3

The report develops criteria for determining the suitability of applying composite materials to helicopter synchronizing drive shafts. A discussion of composite materials and power transmission shafting is given. The factors involved in making an economic decision are vonsidered and suggestion for their evaluation is made. Author (GRA)

N72-27044# Dynamic Science, Phoenix, Ariz.
A SURVEY OF NAVAL AIRCRAFT CRASH ENVIRONMENTS WITH EMPHASIS ON STRUCTURAL RESPONSE
John J. Glancy and Stanley P. Desjardins Dec. 1971 89 p refs
(Contract N00014-71-C-0318)
(AD-739370; Rept-1500-71-43) Avail: NTIS CSCL 01/2

The report contains the results of research in survival aspects of Naval aircraft crashes. The study was made to identify areas for needed improvement in structural design. A literature study, documented crash data, and firsthand data obtained in interviews with Naval personnel and in visits to Naval facilities established a data base which was used to identify the Naval aircraft crash environment and crash survival problems. The study indicated that the Naval Aircraft Accident Report form should include requests for specific impact variables. It also noted Naval helicopters as a productive area for crashworthiness improvement. GRA

N72-27045# Honeywell, Inc., Minneapolis, Minn. Government and Aeronautical Products Div.
A THREE-AXIS FLUIDIC STABILITY AUGMENTATION

SYSTEM Final Technical Report, 15 Nov. 1968 - 28 Oct. 1970
Harvey D. Ogren Oct. 1971 300 p refs
(Contracts DAAJ02-68-C-0039; DAAJ02-69-C-0036; DA Proj. 1F1-62203-A-141)
(AD-739559; GAPD-21192-FR; USAAMRDL-TR-71-30) Avail: NTIS CSCL 01/3

The report covers the analysis, design, fabrication and laboratory tests of a three-axis hydrofluidic stability augmentation system for a UH-1-type helicopter. The design goal was to improve the handling qualities of the aircraft, without stabilizer bar, in the speed range of 60 to 120 knots. The control problem was analyzed and a system defined through use of analog computer simulation techniques. The defined system was mechanized into three separate controller packages, one for each axis. The system was subjected to temperature and vibration flightworthiness tests. The final tests conducted were closed-loop performance checks using an analog computer to simulate the aircraft dynamics. GRA

N72-27046# Minnesota Univ., Minneapolis.
ANALYSIS OF THE OPENING DYNAMICS OF SOLID FLAT AND RINGSLOT PARACHUTES WITH SUPPORTING WIND TUNNEL EXPERIMENTS Final Report, Dec. 1967 - Oct. 1969
Helmut G. Heinrich, Robert A. Noreen, and James C. Hedtke Feb. 1972 88 p refs
(Contract F33615-68-C-1227; AF Proj. 6065)
(AD-739554; AFFDL-TR-71-95) Avail: NTIS CSCL 01/3

The equations of motion for parachutes inflating under finite mass conditions in a horizontal flow wind tunnel are established and organized in view of the nonsteady terms of canopy size, velocity, included and apparent masses, and the time derivatives of these terms. Wind-tunnel experiments with solid flat and ringslot parachutes are described, the results of which yield graphical and numerical time functions for the terms of the derived equation of motion. The wind-tunnel results are compared with full-size test information and certain identities are shown. The numerical functions are substituted in the equation of motion and force-time histories are calculated. GRA

N72-27047# Hamilton Standard, Windsor Locks, Conn.
ADVANCED TECHNOLOGY V/STOL PROPELLER RETENTION SYSTEM INVESTIGATION Final Report
Edward M. Varholak Jan. 1972 72 p refs
(Contract DAAJ02-70-C-0030; DA Proj. 1G1-62203-D-144)
(AD-739555; USAAMRDL-TR-71-39) Avail: NTIS CSCL 01/3

The objective of this program was to investigate the feasibility of employing a BORSIC/Aluminum composite structure for a propeller blade retention for an advanced-technology, 2000-shp, V/STOL propeller system. This was accomplished by the design of a one-half scale composite retention system, the fabrication of three test elements, and the fatigue test of this system, which is compatible with the 33LF propeller.
Author (GRA)

N72-27048# Naval Air Systems Command, Washington, D.C. Airframe Div.
AIRCRAFT CABIN AIR LEAKAGE RATE, MAXIMUM ALLOWABLE: DERIVATION OF
Norman N. Rubin Jul. 1972 12 p refs
(AD-739687; Rept-530-72-01) Avail: NTIS CSCL 01/3

The report describes an attempt to derive a standard formula for allowable cabin leakage that could be applicable to all military aircraft types. GRA

N72-27049# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: ALOHA AIRLINES, INCORPORATED VICKERS VISCOUNT MODEL 745D, N7415 HONOLULU INTERNATIONAL AIRPORT, HONOLULU, HAWAII, 8 AUGUST 1971
29 Dec. 1971 15 p
(PB-207902; NTSB-AAR-72-2; FILE-1-0013) Avail: NTIS HC $3.00 CSCL 01B

Aloha Airlines, Inc., Vickers Viscount 745D, N7415 was operating as Flight 845 between Hilo and Honolulu, Hawaii. After landing at Honolulu and during taxi to the terminal, smoke was detected coming from below the passenger cabin floor. The aircraft was stopped on the taxiway, the engines were shut down and all passengers and crewmembers evacuated without incident. The fire was extinguished by airport emergency equipment. The Board determined that the probable cause of this accident was an undetected electrical short within the left nickel-cadmium aircraft battery, which resulted in the absorption of an increasing amount of heat energy over an unknown period of time, and progressed to a state of thermal runaway.
Author (GRA)

N72-27050# Hydrospace Research Corp., San Diego, Calif.
MEASUREMENT AND ANALYSIS OF NOISE FROM FOUR AIRCRAFT IN LEVEL FLIGHT (727, KC-135, 707-320B AND DC-9) Final Report, May - Sep. 1971
Carole S. Tanner Sep. 1971 59 p refs
(Contract DOT-FA71WA-2555)
(AD-739870; HRC-TR-S-209; FAA-RD-71-83) Avail: NTIS CSCL 20/1

Measurements of noise from aircraft level flyovers are presented in the form of effective perceived noise level (EPNL) as a function of slant range at the closest point of approach. Four aircraft were investigated (727, KC-135, 707-320B, and DC-9) and the effort involved acquisition of acoustical, meteorological, aircraft tracking, and aircraft operational data. Microphones were located four feet above the ground in an array normal to the flight track. Author (GRA)

N72-27051# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
REDUCTION OF HYPERVELOCITY HEATING WITH ELLIPTICAL LEADING EDGES
Daniel Weiss Feb. 1972 32 p refs
(AD-739869; RE-422) Avail: NTIS CSCL 01B

Elliptical shapes are considered for use on wing and fin leading edges and fuselage chines in hypervelocity flight. Calculated distributions of heating rates and radiation equilibrium temperatures are presented for a family of ellipses at 0 and 60-degree angles of attack. Heating rates were obtained with a finite difference solution to the laminar compressible boundary layer equations combined with an empirically derived inviscid pressure law for two dimensional flow around elliptical cylinders. Reduction of peak heating rates from circular values is shown up to 17 percent with a blunt ellipse of axis ratio 0.6 at zero angle of attack, and 14 percent with a sharp ellipse of axis ratio 1.6 at 60-degree angle of attack for the re-entry condition studied. This represents a 140 degrees R drop in the radiation equilibrium wall temperature (with 0.8 emissivity) for zero attack angle, and 100 degrees R drop for 60-degree angle. The calculated temperature distributions are also used to find shapes having minimum surface area requiring protection above certain temperatures. Author (GRA)

N72-27052# United Aircraft Corp., East Hartford, Conn.
AN INVESTIGATION OF THE QUANTITATIVE APPLICABILITY OF MODEL HELICOPTER ROTOR WAKE PATTERNS OBTAINED FROM A WATER TUNNEL Final Report
Anton J. Landgrebe and Elton D. Bellinger Fort Eustis, Va. AAMRDL Dec. 1971 142 p refs
(Contract DAAJ02-70-C-009; DA Proj. 1F1-62204-A-142)
(AD-739946; UARL-K910917-23; USAAMRDL-TR-71-69) Avail: NTIS CSCL 20/4

An analytical investigation was conducted to evaluate quantitative applications of available model rotor tip vortex patterns from a water tunnel. This evaluation consisted of reducing selected photographic wake data to coordinate form,

and comparing the resulting wake geometries with both theoretical results and available experimental data taken in air. Additionally, the study included an examination of the sensitivity of water tunnel wake geometry to the water tunnel test parameters which did not duplicate full-scale rotor values and the applicability of a water tunnel wake geometry to determine the airloads of a full-scale rotor. Finally, the possibility of developing simplified wake documentation and generalization procedures and improved water tunnel test techniques was assessed. Author (GRA)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators, and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N72-27053* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

USE OF UNILLUMINATED SOLAR CELLS AS SHUNT DIODES FOR A SOLAR ARRAY Patent

Anthony J. Barbera, inventor (to NASA) Issued 27 Jun. 1972 6 p Filed 19 Dec. 1968

(NASA-Case-GSC-10344-1; US-Patent-3,672,999; US-Patent-Appl-SN-785078; US-Patent-Class-136-89) Avail: US Patent Office CSCL 10A

The electrical interconnection of unilluminated solar cells in an array of solar batteries is discussed. Each individual shaded cell is connected in parallel but in opposite polarity with a corresponding cell of an illuminated solar battery. The p-n junction solar cell of the shaded battery acts as a forward biased diode forming a by-pass conducting path around the corresponding illuminated cell should it become nonconductive.

Official Gazette of the U.S. Patent Office

N72-27054*# AiResearch Mfg. Co., Los Angeles, Calif.

PRELIMINARY DESIGN OF AN AUXILIARY POWER UNIT FOR THE SPACE SHUTTLE. VOLUME 3: DETAILS OF SYSTEM ANALYSIS, ENGINEERING, AND DESIGN FOR SELECTED SYSTEM

M. L. Hamilton and W. L. Burriss Washington NASA Apr. 1972 173 p

(Contract NAS3-14408)

(NASA-CR-1995; Rept-71-7300-3.1-Vol-3) Avail: NTIS HC $3.00 CSCL 10A

Numerous candidate APU concepts, each meeting the space shuttle APU problem statement are considered. Evaluation of these concepts indicates that the optimum concept is a hydrogen-oxygen APU incorporating a recuperator to utilize the exhaust energy and using the cycle hydrogen flow as a means of cooling the component heat loads. Author

N72-27055*# National Academy of Sciences-National Research Council, Washington, D.C. Ad Hoc Panel on Solar Cell Efficiency.

SOLAR CELLS: OUTLOOK FOR IMPROVED EFFICIENCY

1972 78 p refs

(Contract NSR-09-012-903)

(NASA-CR-127234) Avail: NTIS HC $6.00 CSCL 10A

Studies are reported on the technical feasibility of increasing the efficiency of solar cells for use in space programs. For individual titles, see N72-27056 through N72-27060.

N72-27056* National Academy of Sciences-National Research Council, Washington, D.C.

THE PANEL'S REPORT

In its Solar Cells: Outlook for Improved Efficiency 1972 p 1-22 refs (For availability see N72-27055 18-03)

CSCL 10A

The panel's considerations, conclusions, and recommendations for improving the efficiency of solar cells are summarized. Topics discussed include: benefits of increased solar cell efficiency, solar cell efficiency, and solar cell materials other than silicon. It is concluded that silicon solar cells offer the best opportunity for increased efficiency at lowest cost and shortest payoff time.

F.O.S.

N72-27057* National Academy of Sciences-National Research Council, Washington, D.C.

AN INTRODUCTION TO THE PHYSICS OF SOLAR CELLS

Joseph J. Loferski *In its* Solar Cells: Outlook for Improved Efficiency 1972 p 25-49 refs (For availability see N72-27055 18-03)

CSCL 10A

The physical processes underlying solar-energy conversion through the photovoltaic effect have been examined. The important roles played by bulk and surface recombination have been discussed. The relation between the basic material parameters and the current voltage characteristics of solar cells were reviewed. The maximum efficiencies for solar-energy conversion that can be expected for a number of semiconductors exceed the best values ever reported for any solar cell by a factor of at least 2. In the case of silicon, there is a considerable gap between the currently encountered 11 percent conversion efficiency and the 16 to 20 percent values predicted by analysis of the photovoltaic effect for that material. Author

N72-27058* National Academy of Sciences-National Research Council, Washington, D.C.

THEORETICAL EFFICIENCY CONSIDERATIONS FOR PHOTOVOLTAIC ENERGY CONVERTERS

Hans J. Quiesser *In its* Solar Cells: Outlook for Improved Efficiency 1972 p 50-55 refs (For availability see N72-27055 18-03)

CSCL 10A

The problem is reviewed of the maximum efficiency of a solar energy converter that can be predicted by first principles and practical efficiency limits that seem reasonable within the state of the art. The p-n junctions in inorganic semiconductors are emphasized. The thermodynamic limit and principal restrictions in approaching this limit are reviewed. Practical improvements beyond today's technology seem possible, especially for silicon, if the knowledge about hole-electron recombination is increased. Brief comments on a variety of proposals for efficiency increase are included. Author

N72-27059* National Academy of Sciences-National Research Council, Washington, D.C.

THE FUNDAMENTALS OF IMPROVED SILICON SOLAR-CELL PERFORMANCE

Martin J. Wolf *In its* Solar Cells: Outlook for Improved Efficiency 1972 p 56-70 refs (For availability see N72-27055 18-03)

CSCL 10A

The loss mechanisms in present silicon solar cells were reexamined and their impact on conversion efficiency in air mass zero and air mass one sunlight analyzed. Attention was focused on the process-dependent losses that affect collection efficiency, voltage factor, and curve factor. The collection efficiency can be improved by 22 percent by reducing the surface recombination velocity for short-wavelength collection efficiency improvement and by increasing the minority carrier lifetime in thin cells to be combined with a drift field at the back contact for better collection in the long-wavelength range. Voltage factor and curve factor together can yield 56 percent efficiency improvement through reduction of base region resistivity, while maintaining the minority carrier lifetime near present values. Accomplishment of these changes should yield conversion efficiency values near 20 percent in air mass zero sunlight. Ideal conversion efficiencies were arrived at through thermodynamically based theories.

Author

N72-27060* National Academy of Sciences-National Research Council, Washington, D.C.
PHOTOSYNTHESIS **c04**
Roderick Clayton *In its* Solar Cells: Outlook for Improved Efficiency 1972 p 71-73 (For availability see N72-27055 18-03)
CSCL 06C

Photosynthesis is discussed in terms of photovoltaic technology. The efficiency of the photosynthesis in plants, and the possible impact on photovoltaic technology are considered.
F.O.S.

N72-27061*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE 1971 NASA/GODDARD-AEROSPACE INDUSTRY BATTERY WORKSHOP, VOLUME 1 Conference Proceedings
17 Nov. 1971 262 p Workshop held in Greenbelt, Md. 17-18 Nov. 1971
(NASA-TM-X-68828) Avail: NTIS HC $15.25 CSCL 10C

The proceedings are reported for the first two sessions of the conference on nickel-cadmium batteries. These two sessions were mainly devoted to discussions of: (1) separators and seals, and (2) cell performance and specification experience. D.L.G.

N72-27062*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE 1971 NASA/GODDARD-AEROSPACE INDUSTRY BATTERY WORKSHOP, VOLUME 2 Conference Proceedings
18 Nov. 1971 233 p Workshop held in Greenbelt, Md., 17-18 Nov. 1971
(NASA-TM-X-68829) Avail: NTIS HC $13.75 CSCL 10C

The proceedings of the final two sessions the conference on nickel-cadmium batteries are reported. The major subject areas covered in these two sessions include: (1) materials and pre-charge, and (2) thermal problems experienced with nickel-cadmium batteries. D.L.G.

N72-27063*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
POWERPLEXER Patent Application
Joseph M. Woods, inventor (to NASA) Filed 31 May 1972 26 p
(NASA-Case-MSC-12396-1; US-Patent-Appl-SN-258331) Avail: NTIS HC $3.50 CSCL 10A

An electrical power distribution system is described for use in providing different dc voltage levels. A circuit is supplied with dc voltage levels and commutates pulses for timed intervals onto a pair of distribution wires. The circuit is driven by a command generator which places pulses on the wires in a timed sequence. The wire pairs extend to voltage strippers connected to various loads. The voltage strippers each respond to the pulse dc levels on the wire pairs and form different output voltages to each load. NASA

N72-27064*# AiResearch Mfg. Co., Los Angeles, Calif.
PRELIMINARY DESIGN OF AN AUXILIARY POWER UNIT FOR THE SPACE SHUTTLE. VOLUME 4: SELECTED SYSTEM SUPPORTING STUDIES
M. L. Hamilton and W. L. Burriss Washington Apr. 1972 129 p refs 5 Vol.
(Contract NAS3-14408)
(NASA-CR-1996; Rept-71-7300-3.2-Vol-4) Avail: NTIS HC $3.00 CSCL 10B

Selected system supporting analyses in conjunction with the preliminary design of an auxiliary power unit (APU) for the space shuttle are presented. Both steady state and transient auxiliary power unit performance, based on digital computer programs, were examined. The selected APU provides up to 400 horsepower out of the gearbox, weighs 227 pounds, and requires 2 pounds per shaft horsepower hour of propellants. Author

N72-27065*# Heliotek, Sylmar, Calif.
RESEARCH AND DEVELOPMENT OF SILICON SOLAR CELLS FOR LOW SOLAR INTENSITY AND LOW TEMPERATURE APPLICATIONS Final Report
P. Payne Feb. 1972 77 p refs
(Contract NAS2-5519)
(NASA-CR-114475) Avail: NTIS HC $6.00 CSCL 10A

Problems were identified, using N/P solar cells at low temperature and low intensity; these problems were solved and the solutions incorporated in a manufacturing procedure. Theoretical analysis of the effects of low temperature and low intensity on the various solar cell characteristics indicated that the following behavior might be expected: (1) lower short circuit current,(2) higher open circuit voltage,(3) series resistance becoming less significant, and (4) shunt resistance becoming more critical. Author

N72-27066*# Heliotek, Sylmar, Calif.
PART SPECIFICATION SOLAR CELLS, SILICON N-ON-P SOLDERLESS LOW TEMPERATURE OPERATION FOR JUPITER MISSIONS
P. Payne 3 Apr. 1972 37 p
(Contract NAS2-5519)
(NASA-CR-114476) Avail: NTIS HC $4.00 CSCL 10A

The requirements for 10 ohm cm N-ON-P, silicon solar cells, for use on solar panel assemblies for space flight applications are specified. Author

N72-27067# Office of Naval Research, Washington, D.C.
SOME ASPECTS OF JAPANESE ENERGY-CONVERSION RESEARCH AND DEVELOPMENT
Ralph Roberts 29 Feb. 1972 30 p
(AD-739325; ONR-29) Avail: NTIS CSCL 21/9

The Japanese effort in chemical propulsion has shown a marked technological advance in capabilities in the 10 years since the prior visit of the author. However, in spite of this growth, there was little evidence of marked new contributions by the Japanese. For the most part, excellent application has been made of technology developed, primarily in the United States. Continued growth in this field can be anticipated, with increased Japanese capability in satellites orbiting with larger payloads. In addition a shift from solid-propellant to liquid-propellant rockets may take place; however, this is not anticipated within less than 5 years except by licensing from U.S. corporations of purchase of high-thrust liquid-propellant rocket motors. The same situation generally prevails in the fuel-cell and battery activities visited. In this field the close ties to U.S. development, as in the case of solid-propellant rocketry, were apparent. It will be especially interesting to observe the future fuel-cell developments and whether fuel cells will be reduced to submarine practice.
Author (GRA)

N72-27068# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SEALED CADMIUM-NICKEL BATTERIES
Shou-shung Wu 30 Dec. 1971 9 p Transl. into ENGLISH from Tien Shih Chieh (Mainland China), v. 17, no. 7, 1964 p 271
(AD-739211; FTD-HT-23-1570-71) Avail: NTIS CSCL 10/3

After a brief description of the advantages of sealed type cadmium-nickel storage batteries, the author discusses its performance theory, construction and applications. A table is also given summarizing the models, weight and capacity of such batteries produced in France, Soviet Russia, West Germany and Belgium. Author (GRA)

N72-27069# Boeing Co., Philadelphia, Pa. Vertol Div.
SECONDARY POWER SYSTEM STUDY FOR ADVANCED ROTARY WING AIRCRAFT Final Report
John Karpis, Louis J. Levine, Richard D. Semple, and Raymond G. Smith Nov. 1971 215 p refs
(Contract DAAJ02-70-C-0046)

(AD-739480; D210-10273-1; USAAMRDL-TR-71-52) Avail: NTIS CSCL 10/2

The report describes the results of a study to determine three optimum secondary power systems (SPS) for advanced rotary-wing aircraft, using three different levels of technology, and to recommend research and development required to achieve technological advancements in SPS components that can provide significant improvements for future aircraft.

Author (GRA)

N72-27070# Dayton Univ., Ohio. Research Inst.
COMPUTER STUDIES OF ELECTRIC FIELDS AND FLUID FIELDS IN ELECTROFLUID DYNAMIC GENERATORS Final Technical Report, 3 Oct. 1968 - 2 Oct. 1971
John E. Minardi and Paul T. Bauer Dec. 1971 96 p refs
(Contract F33615-69-C-1113; AF Proj. 7116)
(AD-739547; UDRI-TR-71-50; ARL-71-0318) Avail: NTIS CSCL 10/2

Computer Studies of electric fields for an electrofluid dynamic generator of realistic geometry are presented. A technique of numerical superposition is described and applied to the specific generator configuration. A study of electric breakdown in the absence of charges is presented. It is concluded that a more sophisticated treatment of the breakdown phenomena will be required to accurately predict breakdown in inhomogeneous electric fields and a possible technique is suggested that would be compatible with the available computer program. In addition, electric field studies are presented on basic configurations of simple geometry that are not amenable to analytical solutions of Poissons equation. Finally, a discussion is presented of a detailed model of the fluid flow field in the generator which is required to determine more realistic charge densities and gas densities in an electrofluid dynamic generator.

Author (GRA)

N72-27071# Army Electronics Command, Fort Monmouth, N.J.
INVESTIGATIONS ON ORGANIC ELECTROLYTE LITHIUM-C(X)F CELLS
Achille L. Almerini Feb. 1972 20 p refs
(DA Proj. 1T6-62705-A-053)
(AD-739488; ECOM-3531) Avail: NTIS CSCL 10/3

Internal investigations on lithium organic electrolyte single cells with C(X)F cathodes are at present emphasizing optimization of cathode fabrication methods and choice of the preferred x level (degree of fluorination). The C(3.5)F level was shown in a fractional factorial design experiment to be significantly preferable to C(4.5)F to increase energy density. More highly fluorinated graphites were also procured (i.e., C2F and CF) and show promise of ultimately yielding cell outputs of well over 100 Wh/lb.

Author (GRA)

N72-27072# Army Electronics Command, Fort Monmouth, N.J.
EXPERIMENTAL STUDY OF GERMANIUM CELL PERFORMANCE WITH ERBIUM OXIDE AND SILICON CARBIDE RADIATORS
G. E. Guazzoni and E. Kittl Feb. 1972 34 p refs
(DA Proj. 1T6-62705-A-053)
(AD-739489; ECOM-3539) Avail: NTIS CSCL 10/2

The results of an experimental investigation are reported covering measured data of the output of a germanium (Ge) photovoltaic cell of the N/P(-) alloyed junction type and data on the radiancy of erbium oxide (Er_2O_3) and silicon carbide (SiC) thermal emitters in the temperature range of 1200-2000K. A range of incident radiation on the cell from 0 to 5 W/sq cm was used for both types of radiators. Cell output performance is presented in the ratio I(sc)/H(T) which represents the short circuit current output of the cell divided by the total incident radiation. This ratio, called the chromatic response of the Ge-cell, strongly depends on the spectral match between incident radiation and spectral response of the cell. It is concluded that the use of Er_2O_3 as a radiator material can provide, depending on the operating temperature, a 50-100% increase in the conversion efficiency of a Ge-cell thermophotovoltaic-generator when compared with SiC.

Author (GRA)

N72-27073# Army Electronics Command, Fort Monmouth, N.J.
ENGINEERING EVALUATION OF NONRESERVE ZINC AIR CELLS
Rose Rinaldi Jan. 1972 28 p
(DA Proj. 1T6-62705-A-053)
(AD-739490; ECOM-3528) Avail: NTIS CSCL 10/3

An engineering evaluation program was conducted at ECOM on AA size primary, non-reserve zinc-air cells, procured from Leesona Moos Laboratories, Great Neck, New York. The cells were evaluated under a variety of rate and temperature conditions to determine feasibility of the system to meet representative manpack communications requirements.

Author (GRA)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N72-27074 National Lending Library for Science and Technology, Boston Spa (England).
ACTIVATION OF BIOLOGICAL PROPERTIES OF STAPHYLOCOCCI ISOLATED FROM PERSONS DURING A PROLONGED STAY IN AN AIRTIGHT CHAMBER
V. Ya. Prokhorov, V. M. Shilov, A. K. Akatov, and I. A. Parchinskaya May 1972 8 p refs Transl. into ENGLISH from Zh. Mikrobiol. Epidemiol. i Immunobiol. (Moscow), v. 48, no. 9, 1971 p 63-68
(NLL-RTS-7117) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.70; 2 NLL photocopy coupons

The biological properties of staphylococci isolated from human subjects in the course of a 12-month medical engineering experiment were determined. Efforts were also made to determine if an exchange of microorganisms between the subjects can take place. A combined investigation was carried out to differentiate between pathogenic and nonpathogenic staphylococci. Seeding materials were taken from the nasal mucosa. Besides phage typing, the isolated strains were tested for the presence of enzymes, haemolysins, toxin formation, sensitivity to antibiotics, and virulence. Conclusions show that for long periods of time in a pressurized cabin, pathogenic staphylococci are transmitted from one to another. It was suggested that such activity is associated with the development of diseases of stapylococcal aetiology. Staphylococci strains isolated from humans show increased biological activity.

Author

N72-27075 National Lending Library for Science and Technology, Boston Spa (England).
REACTION MECHANISM OF Na(PLUS)-K(PLUS) DEPENDENT ATP-ase
T. Kanazawa Apr. 1972 47 p refs Transl. into ENGLISH from Seikagaku (Tokyo), v. 42, no. 10, 1970 p 1-24 (777-801)
(NLL-RTS-6898) Avail: Natl. Lending Library, Boston Spa, Engl.: £4.50; 15 NLL photocopy coupons

The association of the active transport of Na(+) and K(+) and the decomposition of ATP by the enzyme are assumed to be significant in elucidating the molecular mechanism of active transport. ATP-ADP cross reactions and the phosphorylation of enzyme proteins are considered. The reaction rate theory analysis of the stationary state is presented. The decomposition reaction of the phosphorylation intermediate (EP) and the EP formation are also considered.

K.P.D.

N72-27076*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 102, MAY 1972
May 1972 147 p refs

(NASA-SP-7011(102)) Avail: NTIS HC $3.00 CSCL 06E

This special bibliography lists 456 reports, articles, and other documents introduced into the NASA scientific and technical information system in April 1972. Author

N72-27077*# Food and Drug Administration, Cincinnati, Ohio. Div. of Microbiology.

ECOLOGY AND THERMAL INACTIVATION OF MICROBES IN AND ON INTERPLANETARY SPACE VEHICLE COMPONENTS Quarterly Progress Report, 1 Jan. - 31 Mar. 1972

A. L. Reyes, A. J. Wehby, R. G. Crawford, J. C. Wimsatt, and J. E. Campbell 1 Jun. 1972 11 p

(NASA Order R-36-015-001)

(NASA-CR-127525; QPR-28) Avail: NTIS HC $3.00 CSCL 06M

The pregermination phenomenon of spores relative to thermal activation and 100% relative humidity is examined. Attempts were also made to determine the effects of suspending media on the spores. Results show spores treated initially in TGE broth lost their heat resistance in contrast to those treated in 2X distilled water. Morphological changes of spores when viewed under phase microscopy are compared to those assayed by a plate count method. E.H.W.

N72-27078*# Mayo Clinic, Rochester, Minn.

EFFECTS PLUS Gy ACCELERATION ON BLOOD OXYGEN SATURATION AND PLEURAL PRESSURE RELATIONSHIPS IN DOGS BREATHING FIRST AIR, THEN LIQUID FLUOROCARBON IN A WHOLE BODY WATER IMMERSION RESPIRATOR

D. J. Sass, E. L. Ritman, P. E. Caskey, J. Greenleaf, N. Banchero, D. Mair, and E. H. Wood [1972] 16 p refs Repr. from AGARD Conf. Proc. no. 82 Sponsored in part by the Navy

(Grant NGR-24-003-001; Contract F41609-69-C-0058; Grant NIH HE-3532)

(NASA-CR-127262) Avail: NTIS HC $3.00 CSCL 06E

A total body water immersion, mechanical respiration, body support assembly has been used with dogs on the human centrifuge to compare effects of +1 Gy and +6 Gy acceleration on cardiovascular and respiratory function in dogs under three conditions: (1) normal respiration in air; (2) totally immersed in a saline-filled respiratory chamber providing control of respiratory rate, tidal and residual volumes when breathing air or oxygen; and (3) when respired in the same manner with oxygenated liquid fluorocarbon. Intrathoracic pressures were recorded by strain-gauge manometers connected to fluid-filled catheters introduced without thoracotomy into the thoracic aorta, pulmonary artery, right and left atria, left pulmonary vein, and right and left pleural spaces. Three cuvette oximeters measured oxygen saturation of blood continuously withdrawn from the thoracic aorta, pulmonary artery, and left pulmonary vein. Oxygen saturation measurements and intrathoracic pressures were analyzed on-line by a CDC 3300 digital computer. Results are included. Author

N72-27079*# Translation Consultants, Ltd., Arlington, Va.

THE EXISTENCE AND ACTIVITY OF THRYOCALCITONIN IN MAN

G. Milhaud, M. S. Moukhtar, J. Bourichon, and A. M. Perault Washington NASA Jun. 1972 7 p refs Transl. into ENGLISH from Compt. Rendu Acad. Sci. (Paris), v. 261, 1965 p 4513-4516

(Contract NASw-2038)

(NASA-TT-F-14341) Avail: NTIS HC $3.00 CSCL 06P

The hypocalcemic activity of extracts purified from six human thyroids in rats, or monkeys, is shown. Hog thyrocalcitonin injected in man can result in a reduction in the calcemia. Author

N72-27080# Civil Aeromedical Inst., Oklahoma City, Okla.

A COMPARISON OF SERUM CHOLINESTERASE METHODS, 2

Charles R. Crane, Donald C. Sanders, and John K. Abbott Mar. 1972 9 p refs

(FAA-AM-72-12) Avail: NTIS HC $3.00

Among aerial applicator personnel, the primary value of periodic blood cholinesterase (ChE) assays is the detection of pesticide poisoning indicated by a decrease in enzyme activity since the previous (or pre-season) assay. Comparison of these values is difficult if they are based on different methodologies and expressed in different units, which is frequently the case. An evaluation was made of four serum or plasma ChE methods which are currently in use and the relationships for interconversion among their respective units are established. This was accomplished by performing simultaneous assays by each method on a series of samples whose activities covered the range from normal levels down to the very low level found in organophosphate-poisoned individuals. The resulting conversion data (regression equations) are also compatible with those described in other investigations. Author

N72-27081*# Scientific Translation Service, Santa Barbara, Calif.

SPACE BIOLOGY

A. A. Imshenetskiy Washington NASA Jul. 1972 37 p refs Transl. into ENGLISH from Usp. Mikobiol. (USSR), no. 7, 1971 p 46-66

(Contract NASw-2035)

(NASA-TT-F-14307) Avail: NTIS HC $4.00 CSCL 06M

The results of studies on microorganisms with a direct bearing on space biology are presented. The experimental studies have indicated that certain enzymes are stable when exposed to an ultrahigh vacuum; synergism occurs when two bacteriocidal gases are used; and certain microbes can grow, even if the substrate moisture level is very low. Author

N72-27082*# Louisiana State Univ., Baton Rouge. Dept. of Electrical Engineering.

SELECTED BIBLIOGRAPHY ON THE MODELING AND CONTROL OF PLANT PROCESSES

Murli Monahar Viswanathan and Paul M. Julich 1972 18 p refs

(Grant NGR-19-001-024)

(NASA-CR-127426) Avail: NTIS HC $3.00 CSCL 02D

A bibliography of information pertinent to the problem of simulating plants is presented. Detailed simulations of constituent pieces are necessary to justify simple models which may be used for analysis. Thus, this area of study is necessary to support the Earth Resources Program. The report sums up the present state of the problem of simulating vegetation. This area holds the hope of major benefits to mankind through understanding the ecology of a region and in improving agricultural yield. Author

N72-27083# National Research Council of Canada, Ottawa (Ontario).

NEW APPROACH TO THE CONTROL OF MUSCULAR ACTIVITY

L. S. Aleev 1972 11 p refs Transl. into ENGLISH from Nauchnyi Sovet po Kibernetike, Akad. Nauk Ukr. Ukr. SSR, Sektsiya Kibernetiki KDNTP (Kiev), 1966 p 102-113

(NRC-TT-1551) Avail: NTIS HC $3.00

A system of bioelectric control of certain motions of man was developed. The system is based on a study of changes in the bioelectric activity of functional-dynamic groups in the space-time ratio on accomplishing active motor actions in different planes. Preliminary tests of the control device were carried out at a neurological clinic for the treatment of motion disturbances caused by a cutoff of the nucleus of the motor analyzer. Encouraging results were obtained and it was concluded that the method provides a new approach to the problem of controlling the motions of man under normal conditions and certain specific conditions, as well as in the treatment of certain motor disturbances. D.L.G.

N72-27084*# Illinois Univ., Urbana. Engineering Experiment Station.
STEADY STATE AND TRANSIENT TEMPERATURE DISTRIBUTIONS IN THE HUMAN THIGH COVERED WITH A COOLING PAD
R. J. Leo, A. Shitzer, J. C. Chato, and B. A. Hertig Jun. 1971 83 p refs
(Grant NGR-14-005-103)
(NASA-CR-127523; ME-TR-286) Avail: NTIS HC $6.25 CSCL 06P

An analytical and experimental study was done on the performance of cooling pads attached to a human thigh. Each cooling pad consisted of a long, water cooled tube formed into a serpentine shape with uniform spacing between the parallel sections. The analytical work developed a cylindrical model for the human thigh. The transient times predicted by this model ranged from 25 to 80 minutes, which is reasonably close to the experimental results. Calculated and measured steady state temperature profiles were in fair agreement. The transient times associated with a change from a high metabolic rate of 1800 Btu/hr (528 w) to a low level of 300 Btu/hr (88 w), were found to be about 120 minutes. A change from 300 Btu/hr (264 w) to 300 Btu/hr (88 w) resulted in 90 to 100 minute transients. However, the transient times for a change in metabolic rate in the opposite direction from 300 Btu/hr (88 w) to 1800 Btu/hr (528 w) were 40 to 60 minutes. Author

N72-27085# Illinois Univ., Savoy. Aviation Research Lab.
PILOTAGE ERROR IN AREA NAVIGATION: PERFORMANCE OF INSTRUMENT PILOTS USING SYMBOLIC DISPLAYS Final Report, 1 Apr. 1970 - 31 Mar. 1971
Richard S. Jensen, Richard J. Vanderkolk, Patrick Fitzhenry, Donald J. Rose, and Stanley N. Roscoe May 1971 181 p refs
(Contract DOT-FA70WA-2322)
(AD-739309; ARL-71-11/FAA-71-1; FAA-RD-71-31) Avail: NTIS CSCL 05/10

Pilotage errors in area navigation were measured both in flight and in a flight simulation laboratory. Experimental procedures were designed to test instrument pilots under relatively demanding flight situations representative of IFR terminal area and final approach operations. Experimental display variables include linear versus angular steering error indications, steering error scale factor, and integrated versus separated presentations of heading and course deviation. Although the data are preliminary, steering error magnitudes were generally consistent with those assumed in Advisory Circular AC 90-45 provided an appropriate scale factor is used. Relatively frequent procedural blunders occurred in the operation of currently typical RNAV controls. Pilot performances in the simulator were comparable to those observed under similar task conditions in flight, thereby supporting the use of the simulator in more systematic studies of display, control, and procedural variables in area navigation.
Author (GRA)

N72-27086# School of Aerospace Medicine, Brooks AFB, Tex.
BIOACOUSTIC NOISE PROBLEMS DURING OPERATION OF C-7A CARIBOU AIRCRAFT Final Report, Jun. - Nov. 1970
Donald C. Gasaway Dec. 1971 25 p refs
(AF Proj. 7755)
(AD-738627; SAM-TR-71-12) Avail: NTIS CSCL 06/19

Noise environments within the DeHavilland C-7A Caribou during various phases of ground and airborne operation are illustrated and described. Noise profiles are provided to identify and describe exposures to noise encountered by unprotected personnel at different occupied locations in the C-7A during takeoff, climb, and cruise. Features of aeromedical significance are also identified and discussed. Author (GRA)

N72-27087# School of Aerospace Medicine, Brooks AFB, Tex.
HAZARD STUDY OF SIX HELIUM-NEON LASER BORESIGHTS Final Report
William A. Fife and Melvin B. Dobbs Feb. 1972 13 p
(AF Proj. 7784)
(AD-738629; SAM-TR-72-5) Avail: NTIS CSCL 06/18

Six helium-neon laser boresights at US Air Force bases in the continental United States were surveyed to determine their output power. The study indicated the measured output power of these devices to be significantly below their rated output power of 1.3 mW. The measured output power ranged from 0.97 to 0.14 mW. The laser boresights surveyed do not constitute eye hazards as defined in AFM 161-8 (C1), 27 September 1971. Author (GRA)

N72-27088# Navy Experimental Diving Unit, Washington, D.C.
REVIEW AND ANALYSIS OF CASES OF DECOMPRESSION SICKNESS OCCURRING UNDER PRESSURE Final Report
James K. Summitt and Thomas E. Berghage 1 Dec. 1971 54 p refs
(AD-737700; NEDU-RR-12-71) Avail: NTIS CSCL 06/19

The increased frequency of decompression sickness occurring while the diver is still under pressure necessitates establishment of a standardized procedure to treat those cases which are beyond the scope of currently accepted treatment tables. Helium diving accident and treatment data were analyzed to evaluate the therapeutic adequacy of the treatment procedures that have been used for treating the helium diver stricken while under pressure; to delineate precipitant factors which may be important in the etiology or treatment of decompression sickness occurring under pressure during helium dives; to extract from the data any parameters which appeared to be related to a more adequate or effective treatment profile; and, finally, to outline treatment procedures which could be used in the management of decompression sickness occurring under pressure. Author (GRA)

N72-27089# Texas Technological Univ., Lubbock.
MONITORING PERFORMANCE ACROSS SENSE MODES: AN INDIVIDUAL DIFFERENCES APPROACH
Dolores M. Tyler, Wayne L. Waag, and Charles G. Halcomb Jan. 1972 31 p refs
(Contract DAAD05-69-C-0102)
(AD-737735) Avail: NTIS CSCL 05/10

The investigation attempted to equate task difficulty across sense modes on an individual basis. The critical dimension for the detection task used in the investigation was stimulus duration. For each subject, stimulus durations were obtained for both visual and auditory presentation which resulted in similar detection rates. These uniquely determined values were then defined as signals in a later monitoring task. Author (GRA)

N72-27090# Whittaker Corp., Waltham, Mass. Space Sciences Div.
DEVELOPMENTS IN MODELLING VISUAL-VESTIBULAR INTERACTIONS Final Report
Laurence R. Young Nov. 1971 93 p refs
(Contract F33615-69-C-1425; AF Proj. 7231)
(AD-737795; AMRL-TR-71-14) Avail: NTIS CSCL 06/19

An earlier report described a physical analog of the human vestibular system, which simulated nystagmic eye movements and subjective sensation of motion based on sensed motion of the head. This report reviews a number of possible extensions to this model--emphasizing the complex interactions among visual, otolith, and canal stimuli. Models are discussed for semicircular canals and otoliths, the vestibulo-ocular reflex, optokinetic and galvanic stimulation of eye movements, counterrolling, visual-vestibular interaction and pursuit eye movements.
Author (GRA)

N72-27091# School of Aerospace Medicine, Brooks AFB, Tex. Aerospace Medical Div.
AN AUTOMATED, SIX-CHANNEL, DISCRETE-SAMPLE ELECTROLYTE ANALYZER Final Report, Oct. 1969 - Aug. 1970
George E. Westlake and Wendell R. Peters Jan. 1972 22 p Submitted for publication

(AF Proj. 7996)
(AD-737568; SAM-TR-72-1) Avail: NTIS CSCL 06/12

A six-channel discrete-sample analyzer (the RPT-720) capable of analyzing clinical specimens at the rate of 120 samples per hour is described. The machine is designed for an electrolyte battery consisting of sodium, potassium, chloride, bicarbonate, calcium, and phosphate. The machine uses ultramicro quantities of serum averaging around 29 microliters of sample per test. The basic principle of operation is use of a peristaltic pump to transfer sample and reagents from the sample turntable to the reaction turntable. Author (GRA)

N72-27092# Naval Ship Research and Development Center, Bethesda, Md.

THE POSITION OF EARDRUM RUPTURE AND HEARING LOSS IN THE SCALE OF INJURIES FROM NUCLEAR BLAST

Joseph Gesswein and Paul Corrao Feb. 1972 36 p refs
(AD-737643; NSRDC-3789) Avail: NTIS CSCL 06/5

The scanty data available on human eardrum rupture from blast pressure suggest a normal distribution of rupture about a median overpressure of 15 psi. More abundant data are available on blast-induced eardrum rupture in animals, but their value is limited because of the lack of scaling laws. Consequently, predictions for human injury stem from clinical experiences. As an injury mode to shipboard personnel, eardrum rupture will be of secondary importance to other blast-induced injuries. In fact, rupture itself may be beneficial to the individual by preventing damage to the middle ear. However, hearing loss associated with blast pressure or rupture itself will compromise normal voice communication. Although ear protection is advisable, it should be made available only in conjunction with protection against other blast effects. Author (GRA)

N72-27093# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

THE EFFECTS OF HIGH INTENSITY NOISE ON HUMAN EQUILIBRIUM

C. Stanley Harris and Henning E. vonGierke Dec. 1971 24 p refs Presented at Aerospace Medical Assoc. Meeting, Washington, D. C., Apr. 1967
(AF Proj. 7231)
(AD-737826; AMRL-TR-67-41) Avail: NTIS CSCL 06/19

Five experiments were conducted on the effects of broadband, high intensity noise on human equilibrium. The ability of subject to balance on narrow rails was measured during exposure to the noise and immediately after termination of the noise. Four different noise conditions were used in each experiment: control, 120, 130, and 140 dB (re. 0.0002 dyne/sq cm). In the first experiment subjects wore earmuffs and earplugs; in the second, only earplugs were worn; and in the third experiment, subjects wore earplugs and one earmuff to produce an asymmetrical exposure. At an ambient level of 140 dB, a detrimental effect was obtained in all three experiments. At lower intensities of noise, there were performance decrements only for the asymmetrical exposure. In the remaining two experiments, conducted after termination of the noise, detrimental effects were obtained for asymmetrical auditory exposure but not for equal auditory exposure. The results of these experiments are interpreted as a possible quantitative demonstration of the direct effect of high intensity noise on the vestibular system.
Author (GRA)

N72-27094# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

ANALYSIS OF THE VESTIBULO-OCULAR COUNTERROLL REFLEX IN PRIMATES Final Report

A. M. Junker, C. R. Replogle, K. A. Smiles, R. D. Brown, and R. Wheeler Nov. 1971 18 p refs
(AF Proj. 7222)
(AD-737828; AMRL-TR-71-59) Avail: NTIS CSCL 06/19

The vestibulo-ocular reflex manifested by counterroll was used to determine the response dynamics of the vestibular system and alterations in these dynamics subsequent to -Gx exposure. Six rhesus monkeys were tested before and after acceleration exposure to determine if significant changes had occurred in the vestibulo-ocular counterroll reflex. The tests consisted of constant speed rotation, pendular oscillations and multiple sine wave oscillations about the subject's cyclopean axis. Ocular counterroll was recorded using a linear resolver mechanically fixed to the monkey's eyeball. The data collected were analyzed by use of the Fast Fourier Transform. This work demonstrates that there is no significant decrease in the system gain with inputs up to 1Hz; the observed phase lag can be accounted for by a time delay of approximately 0.2 seconds, and there is no significant response alteration caused by acceleration loading up to 75 -Gx. Author (GRA)

N72-27095# Texas A&M Univ., College Station. Dept. of Industrial Engineering.

A STUDY OF THE EFFECTS OF ILLUMINATION AND NOISE ON SIMPLE MOTOR PERFORMANCE M.S. Thesis

Carol A. Gardinier 1971 32 p refs
(AD-739474) Avail: NTIS CSCL 05/10

The paper investigates the effects of two environmental parameters, illumination and noise, on human performance. While many single-factor studies have been made on both illumination and noise, relatively little research has been done to determine multi-factor environmental effects on performance. Studies of the combined effects of various environmental factors would be useful to both government and industry in the maintenance area, such as for obtaining accurate estimates for maintenance task times and repair times. In an organization as large as the Army, for example, this could result in a significant cost reduction. In this study, subjects performed a manual task under four conditions of illumination and noise. The results are reported. GRA

N72-27096# Texas A&M Univ., College Station. Dept. of Industrial Engineering.

A DYNAMIC ANALYSIS OF THE ARM COMPLEX SUBJECTED TO AN EXTERNAL LOAD M.S. Thesis

John S. Bezner May 1971 72 p refs
(AD-739478) Avail: NTIS CSCL 06/2

The purpose of the paper is to investigate the action of the hand, arm, and shoulder complex when that complex is required to perform a definite task. The motion under study is that motion encountered when the human operator is required to turn a crank. The cranking motion is in a horizontal plane which passes through the shoulder joint. The subject is required to keep the arm in this plane of motion throughout the task performance. The moments and forces to which the arm mechanism is subjected are then analytically evaluated.
Author (GRA)

N72-27097# Texas A&M Univ., College Station. Dept. of Industrial Engineering.

THE EFFECTS OF COMBINED ENVIRONMENTAL FACTORS ON HUMAN PERFORMANCE OF A MANUAL TASK: NOISE AND TEMPERATURE M.S. Thesis

Robert P. Lewis May 1971 37 p refs Sponsored by the Army
(AD-739432) Avail: NTIS CSCL 05/10

The effects of two environmental factors, noise and temperature, upon human performance of a simple, well-learned manual dexterity task were examined. The experimental design was a 2x2 factorial, using twelve subjects. The data obtained from scores on a Purdue Pegboard task were analyzed in a randomized block, by means of an analysis of variance. Results indicated that temperature had a significant effect on performance, while noise and the temperature x noise interaction did not.
Author (GRA)

N72-27098# Naval Air Development Center, Johnsville, Pa. Crew Systems Dept.

SOME EFFECTS OF CBRF3 INHALATION AND EPINEPH-

RINE CHALLENGE ON CERTAIN MYOCARDIAL METABOLITE LEVELS Interim Report
Richard A. Rhoden 30 Dec. 1971 61 p refs
(AD-739699; NADC-CS-7114) Avail: NTIS CSCL 06/20

Bromotrifluoromethane (CBrF3) would have considerable potential as a closed environment fire extinguishing agent, except for its membership in that large group of hydrocarbons capable of precipitating irregular heart action when inhaled by persons with elevated levels of blood epinephrine. These experiments were an effort to determine whether myocardial metabolism was impaired in male Wistar rats breathing 79/21 CBrF3/O2 and challenged with 1-epinephrine in what would ordinarily constitute sub-toxic dosages. CNS effects were the major observations in rats exposed to both CBrF3 and epinephrine; all control rats survived without apparent effect. The general picture was consistent with the CBrF3 induction of respiratory depression and hypoxia. Author (GRA)

N72-27060* National Academy of Sciences-National Research Council, Washington, D.C.
PHOTOSYNTHESIS
Roderick Clayton *In its* Solar Cells: Outlook for Improved Efficiency 1972 p 71-73 (For availability see N72-27055 18-03)
CSCL 06C

05 BIOTECHNOLOGY

Includes life support systems, human engineering, protective clothing and equipment; crew training and evaluation and piloting. For related information see also: 04 Biosciences.

N72-27099 Office of Naval Research, Arlington, Va.
NAVAL RESEARCH REVIEWS, VOLUME 25, NO. 3
William J. Lescure, ed. Mar. 1972 33 p refs
Avail: SOD $0.20

Developments in deep sea diving, and studies of lightning triggered by man are presented. For individual titles, see N72-27100 through N72-27101.

N72-27100 Office of Naval Research, Arlington, Va.
THE NAVY AND THE CHALLENGE OF DEEP DIVING
Carl O. Holmquist *In its* Naval Res. Rev., Vol. 25, no. 2 Mar. 1972 p 1-14 Repr. from Underwater Mag., v. 1, no. 3 (For availability see N72-27099 18-05)

The development of deep sea diving technology is reviewed. Topics discussed include: scuba, Sealab experiments, decompression sickness, inert gas narcosis, gas density and viscosity, body heat loss, hydrostatic pressure effects, fluid breathing, life support technology, and functional support of divers. F.O.S.

N72-27101 Stanford Research Inst., Menlo Park, Calif.
TRIGGERED LIGHTNING AND SOME UNSUSPECTED LIGHTNING HAZARDS c13
Edward T. Pierce *In* ONR Naval Res. Rev., Vol. 25, No. 3 Mar. 1972 p 14-33 (For availability see N72-27099 18-05)

Instances of lightning initiated by man's activities are considered. These include the triggering of lightning by high-rise buildings and other tall structures; by rockets trailing wires; by the column of water thrown up by a depth-charge; by the large Apollo 12 rocket; by aircraft; and by thermonuclear explosions. All the incidents occur when the ambient electric field is some 10,000 volts per meter, and the voltage discontinuity between the conductor initiating the lightning and the adjacent atmosphere is about a million volts. It is pointed out that solid-state devices and microcircuitry, computers, plastics, and electrically composite materials, are all quite vulnerable to the effects of lightining. These components are being increasingly used in aircraft construction and operation. Also, as aircraft become bigger and faster they have a greater propensity to trigger lightning. Therefore it is concluded that the lightning hazard to aircraft operation is increasing. Author

N72-27102* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LIQUID WASTE FEED SYSTEM Patent
John B. Hall, Jr., Yi Tung, and Lavern E. Winn, inventors (to NASA) Issued 20 Jun. 1972 6 p Filed 15 Jan. 1970 Supersedes N70-35619 (08 - 19, p 3484)
(NASA-Case-LAR-10365-1; US-Patent-3,670,890; US-Patent-Appl-SN-3151; US-Patent-Class-210-104; US-Patent-Class-210-103; US-Patent-Class-210-110; US-Patent-Class-210-137) Avail: US Patent Office CSCL 13B

A pressurized liquid waste tank feeds liquid waste into liquid waste processing equipment. The processed liquid is pumped into an accumulator tank which has an actuator that opens and closes microswitches as the accumulator tank is filled and emptied. These microswitches control solenoid valves which are located in the lines feeding the liquid waste processing equipment, the accumulator tank and the collecting tank. An electrical circuit ties together the switches and valves in a manner such that sufficient waste liquid is automatically maintained in the liquid waste processing equipment to give optimum system performance in a zero gravity environment.
Official Gazette of the U.S. Patent Office

N72-27103* Baylor Univ., Houston, Tex. Coll. of Medicine.
COMPRESSIBLE BIOMEDICAL ELECTRODE Patent
James D. Frost, Jr., inventor (to NASA) Issued 13 Jun. 1972 5 p Filed 5 Nov. 1970 Supersedes N72-15096 (10 - 06, p 727) Sponsored by NASA
(NASA-Case-MSC-13648; US-Patent-3,669,110; US-Patent-Appl-SN-87222; US-Patent-Class-128-2.1E; US-Patent-Class-128-417; US-Patent-Class-128-DIG.4) Avail: US Patent Office CSCL 06B

An electrode is reported which incorporates a silicone rubber sponge immediately adjacent to a chlorided silver disk carried in a silicone rubber base. The electrode is covered with a thin leak-proof vinyl coating for storing electrolyte solution from the point of manufacture. The sponge rubber holds the electrolyte until it is required at the time of usage. A force on the exterior causes the electrolyte to moisten the skin to provide good ohmic contact with the subject.
Official Gazette of the U.S. Patent Office

N72-27104*# North American Rockwell Corp., Downey, Calif. Space Div.
A STUDY OF HUMAN PERFORMANCE IN A ROTATING ENVIRONMENT
J. A. Green, J. L. Peacock, and A. P. Holm [1971] 236 p refs (Contract NAS1-9711)
(NASA-CR-111866; SD-70-456) Avail: NTIS HC $14.00 CSCL 05E

Consideration is given to the lack of sufficient data relative to the response of man to the attendant oculovestibular stimulations induced by multi-directional movement of an individual within the rotating environment to provide the required design criteria. This was done to determine the overall impact of artificial gravity simulations on potential design configurations and crew operational procedures. Gross locomotion and fine motor performance were evaluated. Results indicate that crew orientation, rotational rates, vehicle design configurations, and operational procedures may be used to reduce the severity of the adverse effects of the Coriolis and cross-coupled angular accelerations acting on masses moving within a rotating environment. Results further indicate that crew selection, motivation, and short-term exposures to the rotating environment may be important considerations for future crew indoctrination and training programs. Author

N72-27105# Civil Aeromedical Inst., Oklahoma City, Okla.
METHODOLOGY IN THE MEASUREMENT OF COMPLEX HUMAN PERFORMANCE: TWO-DIMENSIONAL COMPENSATORY TRACKING
Alan E. Jennings, W. Dean Chiles, and Georgetta West May 1972 14 p refs
(FAA-AM-72-21) Avail: NTIS HC $3.00

Nineteen subjects were tested on two successive days on a complex performance device designed to measure functions of relevance to aircrew performance; included were measures of monitoring, information processing, pattern discrimination, and group problem solving. The effects of a perceptualmotor tracking task were evaluated by measuring performance with and without concurrent tracking during five different task combinations and in a tracking-alone condition. The tracking task was shown to be reliable both when performed by itself and when performed concurrently with other tasks. The tracking task was also shown to be sensitive to work load effects from the other tasks and to impose a significant effect on some of the other tasks. The findings also suggest that a composite score based on all concurrently performed tasks may have unique value and sensitivity under some conditions. Author

N72-27106*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SECOND CONFERENCE ON PORTABLE LIFE SUPPORT SYSTEMS
Washington 1972 350 p refs Conf. held at Moffett Field, Calif., 11-13 May 1971
(NASA-SP-302) Avail: NTIS HC $6.00 CSCL 06K

Portable life support systems considered include breathing apparatus, oxygen generating and circulating equipment, thermoregulating diving suits, pressure suits and environmental control systems. For individual titles, see N72-27107 through N72-27133.

N72-27107* Bureau of Mines, Pittsburgh, Pa.
PORTABLE BREATHING APPARATUS FOR COAL MINES
Robert W. VanDolah *In* NASA. Ames Res. Center Second Conf. on Portable Life Support Systems 1972 p 1-4 refs (For availability see N72-27106 18-05)
CSCL 06K

The state of the art in portable oxygen breathing equipment is reported. Considered are self-containing as well as chemically generating oxygen sources and their effectiveness and limitations in mine rescue operations. G.G.

N72-27108* Naval Ship Systems Command, Washington, D.C.
DESIGN CONSIDERATIONS FOR DIVERS' BREATHING GAS SYSTEMS
O. R. Hansen *In* NASA. Ames Res. Center Second Conf. on Portable Life Support Systems 1972 p 5-30 refs (For availability see N72-27106 18-05)
CSCL 06K

Some of the design methods used to establish the gas storage, mixing, and transfer requirements for existing deep dive systems are discussed. Gas mixing systems appear essential to provide the low oxygen concentration mixtures within the converging tolerance range dictated by applications to increasing depths. Time related use of gas together with the performance of the gas transfer system insures a reasonable time frame for systems application. Author

N72-27109* Hamilton Standard, Windsor Locks, Conn. Space Systems Dept.
APOLLO PLSS: ENVIRONMENTAL CONTROL OF THE SMALLEST MANNED SPACE VEHICLE
John C. Beggs and Fred H. Goodwin *In* NASA. Ames Res. Center Second Conf. on Portable Life Support Systems 1972 p 31-48 (For availability see N72-27106 18-05)
CSCL 06K

The production of a portable life support system (PLSS) and associated backup equipment for supporting an astronaut working outside of the lunar module (LM) either in space or on the lunar surface is reported. Described are the system, the philosophy behind its design, basic requirements imposed on the system, and some of the evolutionary processes that led to the present configuration. Author

N72-27110* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO PORTABLE LIFE SUPPORT SYSTEM PERFORMANCE REPORT
Maurice A. Carson *In its* Second Conf. on Portable Life Support Systems 1972 p 49-67 refs (For availability see N72-27106 18-05)
CSCL 06K

The performance of the Apollo portable life support system (PLSS) on actual lunar missions is discussed. Both subjective comments by the crewmen and recorded telemetry data are evaluated although emphasis is on the telemetry data. Because the most important information yielded by the PLSS deals with determination of crewman metabolic rates, these data and their interpretation are explained in detail. System requirements are compared with actual performance, and the effect of performance margins on mission planning are described. Mission preparation testing is described to demonstrate how the mission readiness of the PLSS and the crewmen in verified, and to show how the PLSS and the crewmen are calibrated for mission evaluation. Author

N72-27111* Navy Clothing and Textile Research Unit, Natick, Mass.
NAVY-DEVELOPED LIFE SUPPORT SYSTEMS FOR FULLY ENCLOSED PROTECTIVE SUITS
G. M. Orner and N. F. Audet *In* NASA. Ames Res. Center Second Conf. on Portable Life Support Systems 1972 p 69-80 refs (For availability see N72-27106 18-05)
CSCL 06K

The development and performance of an environmental control unit capable of supporting a man in an impermeable suit at ambient temperatures up to 140 F for periods of up to two hrs is reported. The basic suit operation consists of cooling by wet ice contained in a suitcase. The system is designed to circulate and cool the air within the suit, to remove excess moisture and carbon dioxide, and to maintain a safe oxygen level. G.G.

N72-27112* Westinghouse Electric Corp., Annapolis, Md. Ocean Research and Engineering Center.
A CHLORATE CANDLE/LITHIUM HYDROXIDE PERSONAL BREATHING APPARATUS
Frank E. Martin *In* NASA. Ames Res. Center Second Conf. on Portable Life Support Systems 1972 p 81-99 refs (For availability see N72-27106 18-05)
CSCL 06K

A portable coal mine rescue and survival equipment is reported that consists of a chlorate candle with a lithium hydroxide carbon-dioxide absorbent for oxygen generation, a breathing bag and tubing to conduct breathing to and from the man. A plastic hood incorporating a mouth piece for communication provides also eye protection and prevents inhalation through the nose. Manned testing of a prototype system demonstrated the feasibility of this closed circuit no-maintenance breathing apparatus that provides for good voice communication. G.G.

N72-27113* Hamilton Standard, Windsor Locks, Conn.
ADVANCED EXTRAVEHICULAR PROTECTIVE SYSTEMS
James G. Sutton, Philip F. Heimlich, and Edward H. Tepper *In* NASA. Ames Res. Center Second Conf. on Portable Life Support Systems 1972 p 101-137 (For availability see N72-27106 18-05)
CSCL 06K

New technologies are identified and recommended for developing a regenerative portable life support system that provides protection for extravehicular human activities during long duration missions on orbiting space stations, potential lunar bases, and possible Mars landings. Parametric subsystems analyses consider: thermal control, carbon dioxide control, oxygen supply, power supply, contaminant control, humidity control, prime movers, and automatic temperature control. * G.G.

N72-27114* Vought Missiles and Space Co., Dallas, Tex.
REGENERABLE THERMAL CONTROL AND CARBON DIOXIDE CONTROL TECHNIQUES FOR USE IN ADVANCED EXTRAVEHICULAR PROTECTIVE SYSTEMS
J. L. Williams, R. J. Copeland, and B. W. Nebbon *In* NASA. Ames Res. Center Second Conf. on Portable Life Support Systems 1972 p 139-157 refs (For availability see N72-27106 18-05)
CSCL 06K

The most promising closed CO2 control concept identified by this study is the solid pellet, Mg(OH2)2 system. Two promising approaches to closed thermal control were identified. The AHS system uses modular fusible heat sinks, with a contingency evaporative mode, to allow maximum EVA mobility. The AHS/refrigerator top-off subsystem requires an umbilical to minimize expendables, but less EVA time is used to operate the system, since there is no requirement to change modules. Both of these subsystems are thought to be practical solutions to the problem of providing closed heat rejection for an EVA system. Author

N72-27115* Westinghouse Electric Corp., Annapolis, Md. Ocean Research and Engineering Center.
A PORTABLE LIFE SUPPORT SYSTEM FOR USE IN MINES
Sanford S. Zeller *In* NASA. Ames Res. Center Second Conf. on Portable Life Support Systems 1972 p 159-166 refs (For availability see N72-27106 18-05)
CSCL 06K

The portable life support system described in this paper represents a potential increase in the probability of survival for miners who are trapped underground by a fire or explosion. The habitability and life support capability of the prototype shelter have proved excellent. Development of survival chamber life support systems for wide use in coal mines is definitely within the capabilities of current technology. Author

N72-27116* Battelle Memorial Inst., Columbus, Ohio.
SEMICLOSED-CIRCUIT ATMOSPHERE CONTROL IN A PORTABLE RECOMPRESSION CHAMBER
Peter S. Riegel and Don W. Caudy *In* NASA. Ames Res. Center Second Conf. on Portable Life Support Systems 1972 p 167-182 refs (For availability see N72-27106 18-05) (Contract N00014-70-C-0072)
CSCL 06K

A small portable recompression chamber is described that can be used both to treat a diver for decompression sickness or to transport him to a larger chamber complex. The device can be operated in either open circuit or semiclosed circuit atmospheres, permits two way conversation between patient and attendant, and uses an air injector for circulation of the chamber atmosphere. G.G.

N72-27117* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SKYLAB ASTRONAUT LIFE SUPPORT ASSEMBLY
J. Travis Brown *In its* Second Conf. on Portable Life Support Systems 1972 p 183-201 (For availability see N72-27106 18-05)
CSCL 06K

A comparative study was performed to define an optimum portable life support system for suited operations inside and outside the Skylab Program. Emphasis was placed on utilization of qualified equipment, modified versions of qualified equipment, and new systems made up to state-of-the-art components. Outlined are the mission constraints, operational modes, and evaluation ground rules by which the Skylab portable life support system was selected and the resulting design. Author

N72-27118* General Electric Co., Philadelphia, Pa.
ADVANCED DEEP SEA DIVING EQUIPMENT
William A. Danesi *In* NASA. Ames Res. Center Second Conf. on Portable Life Support Systems 1972 p 203-216 ref (For availability see N72-27106 18-05)
CSCL 06K

Design requirements are generated for a deep sea heavy duty diving system to equip salvage divers with equipment and tools that permit work of the same quality and in times approaching that done on the surface. The system consists of a helmet, a recirculator for removing carbon dioxide, and the diver's dress. The diver controls the inlet flow by the recirculatory control valve and is able to change closed cycle operation to open cycle if malfunction occurs. Proper function of the scrubber in the recirculator minimizes temperature and humidity effects as it filters the returning air. G.G.

N72-27119* Navy Experimental Diving Unit, Washington, D.C.
OPERATION AND TESTING OF MARK 10 MOD 3 UNDERWATER BREATHING APPARATUS
William I. Milwee, Jr. *In* NASA. Ames Res. Center Second Conf. on Portable Life Support Systems (For availability see N72-27106 18-05)
CSCL 06K

Performance tests on a closed circuit, mixed gas underwater breathing apparatus are reported. The equipment is designed to provide a minimum diving duration of four hours at 1500 ft below sea surface; it senses oxygen partial pressure in the breathing gas mix and controls oxygen content of the breathing gas within narrow limits about a preset value. The breathing circuit subsystem provides respirable gas to the diver and removes carbon dioxide and moisture from the expired gas. Test results indicate undesirable variations in oxygen partial pressure with oxygen addition and insufficient carbon dioxide absorption. G.G.

N72-27120* Navy Experimental Diving Unit, Washington, D.C.
THERMAL PROTECTION OF DIVERS
Patrick F. Dowland (Royal Navy) *In* NASA. Ames Res. Center Second Conf. on Portable Life Support Systems 1972 p 229-235 refs (For availability see N72-27106 18-05)
CSCL 06K

Various diving suit-heating element combinations are evaluated in an effort to achieve a diving capability to depths of 1000 ft in water temperatures down to 29 F. Wet suits, dry suits and suits made of incompressible material are reported, and suit heat replacement by circulation of hot water with heating by cemented electrical elements is described. G.G.

N72-27121* National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
A FLIGHT-RATED LIQUID-COOLED GARMENT FOR USE WITHIN A FULL-PRESSURE SUIT
Richard Carpenter and William R. Winter *In its* Second Conf. on Portable Life Support Systems refs (For availability see N72-27106 18-05)
CSCL 06K

A flight rated liquid cooled garment system for use inside a full pressure suit has been designed, fabricated, and tested. High temperature tests with this system have indicated that heat is absorbed at a rate decreasing from 224 kg-cal/hr to 143 kg-cal/hr over a 40-min period. The first 30 min are very comfortable; thereafter a gradual heat load builds that results in mild sweating at the end of the 40-min period. In flight tests during hot weather when this cooling system was worn under a regulation flight suit, the pilot reported that temperatures were comfortable and that the garment prevented sweating. Author

N72-27122* TRW Systems Group, Redondo Beach, Calif.
POTENTIAL TECHNIQUES AND DEVELOPMENT ACTIVITIES IN DIVER SUIT HEATING
A. P. Shlosinger *In* NASA. Ames Res. Center Second Conf. on Portable Life Support Systems 1972 p 247-256 refs (For availability see N72-27106 18-05)
CSCL 06K

A prototype compact reactor suitable for combustion of propane with oxygen under shallow as well as submerged deep submergence diving conditions is reported. The device is used to heat the circulating water in a water tube-type diving suit. G.G.

N72-27123* Mechanics Research, Inc., Los Angeles, Calif.
PORTABLE LIFE SUPPORT FOR INSTRUMENTATION OF AN OFFSHORE PLATFORM
Michael M. Mull and Clarkson L. Coffin *In* NASA. Ames Res. Center Second Conf. on Portable Life Support Systems 1972 p 257-264 (For availability see N72-27106 18-05)
CSCL 06K

A compressor was used to supply air through a nylon hose to the offshore platform field engineer working at the bottom of the piling. Air quality in the pile was sampled periodically for carbon dioxide, carbon monoxide, hydrogen sulfide, and combustible gases by an universal tester and an explosion meter. G.G.

N72-27124* Illinois Univ., Urbana. Dept. of Mechanical and Industrial Engineering.
REMOVAL OF METABOLIC HEAT FROM MAN WORKING IN A PROTECTIVE SUIT
Avraham Shitzer, John C. Chato, and Bruce A. Hertig *In* NASA. Ames Res. Center Second Conf. on Portable Life Support Systems 1972 p 265-281 refs (For availability see N72-27106 18-05)
(Grant NGR-14-005-103)
CSCL 06K

A water cooled garment was constructed and used to study the characteristics of independent regional cooling of the body in contrast to the current practice of uniform cooling. The cooling pads in the garment were grouped to provide independent control of water inlet temperatures and flow rates to six regions: head, upper torso, lower torso, arms, thighs, and lower legs. Experiments with and without the cooling suit were conducted with five test subjects standing and walking on a treadmill on selected schedules. Steady state and, to a lesser extent, transient characteristics were obtained. Author

N72-27125* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A LIQUID COOLED GARMENT TEMPERATURE CONTROLLER BASED ON SWEAT RATE
Alan B. Chambers and James Blackaby *In its* Second Conf. on Portable Life Support Systems 1972 p 283-287 refs (For availability see N72-27106 18-05)
CSCL 06K

An automatic controller for liquid cooled space suits is reported that utilizes human sweat rate as the primary input signal. The controller is so designed that the coolant inlet temperature is inversely proportional to the subject's latent heat loss as evidenced by evaporative water loss. G.G.

N72-27126* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECT OF NECK WARMING AND COOLING ON THERMAL COMFORT
Bill A. Williams and Alan B. Chambers *In its* Second Conf. on Portable Life Support Systems 1972 p 289-294 refs (For availability see N72-27106 18-05)
CSCL 06K

The potential use of local neck cooling in an area superficial to the cerebral arteries was evaluated by circulating cold or hot water through two copper disks held firmly against the neck. Subjective responses indicated that neck cooling improves the thermal comfort in a hot environment. G.G.

N72-27127* Safety in Mines Research Establishment, Sheffield /England/.
TOLERANCE TO EXTERNAL BREATHING RESISTANCE WITH PARTICULAR REFERENCE TO HIGH INSPIRATORY RESISTANCE
R. A. Bentley, O. G. Griffin, R. G. Love, D. C. F. Muir, and K. F. Sweetland *In* NASA. Ames Res. Center Second Conf. on Portable Life Support Systems 1972 p 295-303 refs (For availability see N72-27106 18-05)
CSCL 06K

The ability of men to exercise while breathing through graded inspiratory resistances was studied in order to define acceptable respiratory mouthpiece assembly standards. Experimental results with subjects wearing breathing masks and walking for 30 min on treadmills were used to calculate expiratory work rates. It is concluded that the airflow must be appropriate to the upper limit of minute ventilation likely to be encountered in the men wearing the apparatus. G.G.

N72-27128* Harvard Univ., Cambridge, Mass. School of Public Health.
RESPIRATORY PROTECTIVE DEVICE DESIGN USING CONTROL SYSTEM TECHNIQUES
William A. Burgess and Donald Yankovich (MIT) *In* NASA. Ames Res. Center Second Conf. on Portable Life Support Systems p 305-314 (For availability see N72-27106 18-05)
CSCL 06K

The feasibility of a control system analysis approach to provide a design base for respiratory protective devices is considered. A system design approach requires that all functions and components of the system be mathematically identified in a model of the RPD. The mathematical notations describe the operation of the components as closely as possible. The individual component mathematical descriptions are then combined to describe the complete RPD. Finally, analysis of the mathematical notation by control system theory is used to derive compensating component values that force the system to operate in a stable and predictable manner. Author

N72-27129* International Business Machines Corp., Gaithersburg, Md. Federal Systems Div.
BREATHING METABOLIC SIMULATOR
R. G. Bartlett, C. M. Hendricks, and W. B. Morison *In* NASA. Ames Res. Center Second Conf. on Portable Life Support Systems 1972 p 315-324 refs (For availability see N72-27106 18-05)
CSCL 06K

The development of a breathing metabolic simulator (BMS) is reported. This BMS simulates all of the breathing and metabolic parameters required for complete evaluation and test of life support and resuscitation equipment. It is also useful for calibrating and validating mechanical and gaseous pulmonary function test procedures. Breathing rate, breathing depth, breath velocity contour, oxygen uptake, and carbon dioxide release are all variable over wide ranges simulating conditions from sleep to hard work with respiratory exchange ratios covering the range from hypoventilation. In addition, all of these parameters are remotely controllable to facilitate use of the device in hostile or remote environments. The exhaled breath is also maintained at body temperature and a high humidity. The simulation is accurate to the extent of having a variable functional residual capacity independent of other parameters. Author

N72-27130* Safety in Mines Research Establishment, Sheffield /England/.
INFLUENCE OF FACEMASK DESIGN ON OPERATIONAL PERFORMANCE
O. G. Griffin and D. J. Longson *In* NASA. Ames Res. Center Second Conf. on Portable Life Support Systems 1972

p 325-333 refs (For availability see N72-27106 18-05)
CSCL 06K

Spirometric measurements of oxygen volume and determination of the amount of argon in exhaled breath are used to analyze facemask design efficiency during treadmill walking tests with subjects carrying plastic hoods filled with argon. Facemask leakage measurements established the better performance of a pneumatic seal type mask in comparison with plain seal type masks. Author

N72-27131* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CATALYZED SODIUM CHLORATE CANDLES
C. W. Malich and T. Wydeven *In its* Second Conf. on Portable Life Support Systems 1972 p 335-345 refs (For availability see N72-27106 18-05)
CSCL 06K

The catalytic effect of cobalt powder on chlorate decomposition has been confirmed. Catalysis is enhanced by oxidation of the metal during burning. Catalysts other than cobalt compounds should also be effective; the complete elimination of fuel has shown that the oxidation of cobalt during decomposition is not a vital factor in the improved performance of catalyzed candles. Author

N72-27132* Mechanics Research, Inc., Los Angeles, Calif.
AN EMERGENCY SURVIVAL SUIT
Daniel L. Curtis *In* NASA. Ames Res. Center Second Conf. on Portable Life Support Systems 1972 p 347-350 (For availability see N72-27106 18-05)
CSCL 06K

A thermally insulative inflatable garment designed specifically as a lightweight low storage volume emergency suit for subzero weather survival is reported. Testing confirms that the inflatable suit design satisfies the objectives for a subject standing at rest with environmental temperatures down to -450 F if the garment is inflated with Freon. G.G.

N72-27133* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
AN ALTITUDE CHAMBER RESCUE ENSEMBLE
Russell P. Lloyd *In its* Second Conf. on Portable Life Support Systems 1972 p 351-358 (For availability see N72-27106 18-05)
CSCL 06K

Altitude chamber tests accomplished with the astronaut crews in the spacecraft at a simulated altitude of above 200,000 ft requires that a rescue team be provided in the event of an accident in the spacecraft. The rescue crew is stationed in an airlock maintained at an altitude of 18,000 ft. A protective ensemble provides the rescue crew with life support capabilities, communications, and protection in the event of an emergency. In the event of an emergency, repressurization of the chamber is initiated; as the chamber descends, the airlock ascends and the two meet at 25,000 ft. This phase of the emergency repressurization takes less than 30 sec. Author

N72-27134# National Research Council of Canada, Ottawa (Ontario).
MULTICHANNEL BIOELECTRIC CONTROL OF THE MOVEMENTS OF HUMANS IN NORMAL AND PATHOLOGICAL CONDITIONS
L. S. Aleev and S. G. Bunimovich 1972 10 p refs Transl. into ENGLISH from Proc. of Congr. of the German Cybernetics Soc., Munich, 23-26 Apr. 1968
(NRC-TT-1552) Avail: NTIS HC $3.00

A bioelectric control system, the myolon, simulating certain human neuromuscular motions was developed and tested. The system is based on the multichannel principle utilizing the laws governing the change of mean value of the summary neuromyogram. The control system is designed to record the motion algorithms on a magnetic storage device, derive control signals from the storage device, and derive control signals directly from the donor. The use of the device in training athletes and treating motor function disturbances is discussed. E.H.W.

N72-27135# Technology Service Corp., Santa Monica, Calif.
STRUCTURAL LANGUAGES AND BIOMEDICAL SIGNAL ANALYSIS USING INTERACTIVE GRAPHICS
W. S. Meisel and D. C. Collins Mar. 1972 9 p refs Presented at Biomed. Symp., San Diego, Calif., 2-4 Feb. 1972
(Contract F44620-71-C-0093; AF Proj. 9749)
(AD-739258; AFOSR-72-0616TR) Avail: NTIS CSCL 06/2

The analysis of biological waveforms by computer or by special-purpose hardware can reduce the burden on trained medical manpower, make mass screening of a population more tenable, and allows the automatic analysis of large quantities of research data. Waveforms generated in electrocardiography, phonocardiography, vectorcardiography, cardiac output recording, oxygen consumption recording, electroencephalography, electromyography, and in similar applications are candidates for analysis. A characteristic of many biomedical waveforms in such applications is that many of the features by which classes of waveforms, e.g., abnormal vs. normal EKG's, are distinguished, are generally expressed by fuzzy descriptions of structural details. In EKG analysis, one hears reference to, for example: a depressed S-T segment; an inverted T wave; increased duration of the QRS interval; late onset of the intrinsicoid deflection. It is the intent of this paper to describe a generalized approach to obtaining a quantitative measure of the degree of existence of such a characteristic in a given waveform. Such measures have a clear interpretation and can be used in a heuristic or linguistic program. They are continuous by continuously measured features which can be used alone or in combination with more abstract features in statistical pattern recognition algorithms.
Author (GRA)

N72-27136# Texas A&M Univ., College Station. Dept. of Industrial Engineering.
TECHNIQUES FOR MEASUREMENT OF CENTERS OF GRAVITY M.S. Thesis
Raymond Paul Rhode May 1971 54 p refs Sponsored by Army
(AD-739439) Avail: NTIS CSCL 05/5

A device which would measure and record the position of the projection of the center of gravity in the horizontal plane is proposed. A generalized design of such a device is presented. The proposed system uses strain gage rings as sensing elements and either an analog computer or an analog to digital converter as a recording element. An additional device which would allow the calculation of centers of gravity from a series of three static measurements is also presented. Author (GRA)

N72-27137# Texas A&M Univ., College Station. Dept. of Industrial Engineering.
PSYCHOPHYSIOLOGICAL MEASUREMENTS APPLIED TO MAINTAINABILITY EVALUATION OF EQUIPMENT DESIGN M.S. Thesis
Billy R. Schulze May 1971 50 p refs Sponsored by Army
(AD-739437) Avail: NTIS CSCL 05/5

The paper presents a proposal for using psychophysiological measurements to aid in evaluating equipment designs from the human factors engineering viewpoint. As a preliminary step in examining the feasibility of applying this method, an experiment was conducted to determine if man's reaction to task difficulty as affected by equipment design features is reflected in psychophysiological indices. Subjects were presented with two similar maintenance type tasks to be performed on differently designed pieces of equipment. One task involved equipment which obviously facilitated ease of maintenance. The other task involved equipment which is difficult to maintain. Various psychophysiological measurements were taken of the subjects as these presentations were made. It was found that a majority of the measured indices were higher during the hard task than during the easy task. However, these differences were not

significant at the significance level selected for use in the statistical analysis. Author (GRA)

N72-27138# Applied Psychological Services, Wayne, Pa. Science Center.
MODIFICATION OF THE SIEGEL-WOLF OPERATOR SIMULATOR MODEL FOR ON-LINE EXPERIMENTATION Final Report, Jun. 1968 - Sep. 1969
Arthur I. Siegel, J. Jay Wolf, M. A. Fischl, William Miehle, and Gerald P. Chubb Jun. 1971 117 p refs
(Contract F33615-68-C-1647; AF Proj. 7184)
(AD-737798; AMRL-TR-71-80) Avail: NTIS CSCL 05/10

The primary effort was to modify the existing Siegel-Wolf operator simulation model to allow dynamic interaction with an experimental subject performing on-line in some sort of pseudoreal time environment. The Siegel-Wolf model is capable of simulating task performance by a one or two-man crew to determine the impact human factors have on systems effectiveness and mission success. The BUIC III (Back Up Interceptor Control System for SAGE) active tracking task was used in this work as a representative environment. The other three phases of the effort dealt with the conceptual aspects of the model. Variables known to contribute to performance, but which were not incorporated into the model, were considered to determine their possible contribution to enhancing the model's predictive validity. Author (GRA)

N72-27139# Texas A&M Univ., College Station. Dept. of Industrial Engineering.
INVESTIGATION OF STIMULUS-SIGNAL AMPLITUDE AND FREQUENCY VARIATION IN VIBROTACTILE COMMUNICATION M.S. Thesis
Charles E. Slyker May 1971 62 p refs Sponsored by Army
(AD-739433) Avail: NTIS CSCL 05/5

An electromechanical transducer was modified for use as a vibrotactile stimulus. Response time to the vibrotactile stimulus was measured experimentally at various levels of stimulus-signal amplitude and frequency. Stimulus-signal amplitude levels ranged from 0.1 to 1.6 mm and frequency levels ranged from 30 to 800 Hz. Experimental results indicate that response time to the vibrotactile stimulus quickens with increasing amplitude and frequency and further that response time appears to be converging to an optimum over the range tested. Author (GRA)

N72-27140# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
SYMPOSIUM ON BIODYNAMIC MODELS AND THEIR APPLICATIONS
Dec. 1971 965 p refs Symp. held at Dayton, Ohio, 26-28 Oct. 1970
(AD-739501; AMRL-TR-71-29) Avail: NTIS CSCL 06/2

The Symposium on Biodynamics Models and Their Applications took place in Dayton, Ohio, on 26-28 October 1970 under the sponsorship of the National Academy of Sciences - National Research Council, Committee on Hearing, Bioacoustics, and Biomechanics; the National Aeronautics and Space Administration; and the Aerospace Medical Research Laboratory, Aerospace Medical Division, United States Air Force. Most technical areas discussed included application of biodynamic models for the establishment of environmental exposure limits, models for interpretation of animal, dummy, and operational experiments, mechanical characterization of living tissue and isolated organs, models to describe man:s response to impact, blast, and acoustic energy, and performance in biodynamic environments. Author (GRA)

N72-27882 Joint Publications Research Service, Arlington, Va.
FOR A RENDEZVOUS IN ORBIT
E. Anisimov *In its* Docking Training and Telemetry 11 Jul. 1972 p 1-7 (For availability see N72-27881 18-30)

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N72-27141 National Lending Library for Science and Technolog Boston Spa (England).
ELECTROLYTIC SEPARATION AND CYCLIC VOLTAMETRY OF REDUCTION OF MANGANESE DIOXIDE
M. Sato et al [1971] 14 p refs Transl. into ENGLISH from Kogyo Kagaku Zasshi (Tokyo), v. 4, no. 5, 1971 p 872 In ENGLISH and JAPANESE
(NLL-M-22291-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A study was made of the reducing reactions and electrolytic separation of manganese dioxide in acid solution, by means of cyclic voltametry. It was found that the separation potential of manganese dioxide is low, for a high pH. The polarization curves in the reduction reactions show a tendency to vary according to the pH. If pH is 2 or more, a reduction reaction from manganese dioxide to the lower oxides is noted, together with a peak corresponding to the resolution of the lower oxides, suggesting that the reduction reaction of manganese dioxide is one which encompasses those oxides. Author

N72-27142 National Lending Library for Science and Technology, Boston Spa (England).
CONCERNING THERMAL TRANSFORMATIONS OF CARBO- AND HETERO-CHAIN POLYMERS
R. M. Aseeva, Z. S. Smutkina, A. A. Berlin, and Kasatochkin Apr. 1972 45 p refs Transl. into ENGLISH from Strukt. Khim. Ugleroda i Uglei (Moscow), 1969 p 161-196
(NLL-RTS-7032) Avail: Natl. Lending Library, Boston Spa, Engl.: £4.30; 14 NLL photocopy coupons

Experimental material obtained from investigating the carbonization of carbo- and hetero-chain polymers is summarized. The principle factors influencing the carbonization process and the properties of the end products are included. E.H.W.

N72-27143 National Lending Library for Science and Technology, Boston Spa (England).
ON TIME QUANTIZATION OF CHROMATOGRAPHIC FUNCTIONS
L. A. Kolomytsev 3 Jun. 1971 9 p refs Transl. into ENGLISH from Autometriya (USSR), no. 2, 1970 p 29-36
(NLL-Trans-836-(9022.64)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The optimum quantization interval was determined for the chromatographic function on the basis of the similarity between chromatographic peaks of the Gaussian distribution function. The dependence of the error in quantization with respect to time is considered. The results make it possible to reduce expenditure of computer time necessary for applying chromatographic transducer data to digital regulating computers and to simplify the construction of special digital integrators. K.P.D.

N72-27144* Peninsular ChemResearch, Inc., Gainesville, Fla.
POLYURETHANE RESINS FROM HYDROXY TERMINATED PERFLUORO ETHERS Patent
Eugene C. Stump, Jr. and Stephen Eugene Rochow, inventors (to NASA) Issued 20 Jun. 1972 4 p Filed 18 Dec. 1970 Supersedes N71-33516 (09 - 20, p 3230) Continuation-in-part of US Patent Appl. SN-770398, filed 24 Oct. 1968 Sponsored by NASA
(NASA-Case-NPO-10768-2; US-Patent-3,671,497; US-Patent-Appl-SN-99524; US-Patent-Class-260-77.5AP; US-Patent-Class-260-535H; US-Patent-Appl-SN-770398) Avail: US Patent Office CSCL 07D

The formation of hydroxy terminated perfluoro ethers and

polyurethane resins is reported that incorporate the structure -CH2CF(CF3)((OCF,CF(CF3))mO(CF2)pO((CF(CF3)cf2O)nCF(CF3)-CH2- were p is an integer of 2 to 12 and m and n are integers whose sum is from zero to 20.
Official Gazette of the U.S. Patent Office

N72-27145 National Lending Library for Science and Technology, Boston Spa (England).
HYDROGENATION OF METALS DURING INTERACTION WITH WATER
L. A. Andreev, G. Gelman, A. A. Zhukhovitskii, and E. F. Polosino [1972] 6 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met., (Moscow), no. 1, 1972 p 18-21
(NLL-M-21374-(5828.4F)) Avail: NLL Lending Library, Boston Spa, Engl.; 1 NLL photocopy coupon

In the vacuum extraction of aluminum, the surface of which is subjected to etching in a solution of NaOH, hydrogen generation up to 0.2 cu cm/100g is observed. The total quantity of H2 generated in specimens of equal volume hardly depends on surface area. The effect observed is connected with the solution of hydrogen in a metallic base in the initial stage of vacuum annealing. Saturation of the metal with H2 is due to the oxidation reaction of Al with water in the surface oxide film. Activation energy values for the process of 13000 to 2000 kcal/mol are obtained. The dependence found for the coefficient of gas generation on area confirms that the limiting stage of the process is the diffusion of Al2 through the oxide film. Author

N72-27146 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECT OF CERTAIN VAPOURS AND LIQUIDS ON THE FRICTION PROPERTIES OF MOLYBDENUM DISULPHIDE
J. Gansheimer 7 May 1972 22 p Transl. into ENGLISH from Energie Fluide et Lubrification (France), Oct. 1970 p 85-94
(NLL-Risley-Tr-2363-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

The friction and wear properties of MoS2 were investigated in the presence of water vapor, organic vapor, and liquids. Test apparatus and methods are discussed. K.P.D.

N72-27147 National Lending Library for Science and Technology, Boston Spa (England).
GALVANIC CORROSION OF METALS
4 Apr. 1972 4 p Transl. into ENGLISH of "Kontaktkorrosionsverhalten von Werkstoffpaarungen" Leverkusen, Farbenfabriken Bayer A.G., 1971 2 p In GERMAN and ENGLISH
(NLL-Trans-746-1174-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The mechanism and extent of galvanic corrosion of metals are considered. Test equipment and its mode of operation are described. K.P.D.

N72-27148 National Lending Library for Science and Technology, Boston Spa (England).
BLOCKING THE SPONTANEOUS POLARISATION IN GLYCOL SULPHATE
Armand Hadni, Jean Perrin, Robert Thomas, and Pierre Schoumacher 10 Apr. 1972 5 p refs Transl. into ENGLISH from C. R. Acad. Sci. (Paris), v. 273, 27 Sep. 1971 p 537-540
(NLL-Trans-855-(9022.64)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

An irradiation of about 40 W/sq cm from a helium-neon laser focused at certain points of a crystal of glycol sulfate may lead to nucleation and reversal of one or several domains. This reversal lasts only as long as the irradiation is maintained. Irradiation with X-rays blocks spontaneous polarization. Author

N72-27149*# Geological Survey, Washington, D.C.
SPECTROFLUOROMETER TECHNIQUES APPLICABLE TO SAMPLE SURFACES
George E. Stoertz 1972 51 p refs
(NASA Order L-58514)
(NASA-CR-127257; IR-USGS-NASA-238) Avail: NTIS HC $4.75 CSCL 07D

Methods for correcting fluorescence spectra to remove instrumental artifacts are described, including computational and graphical procedures for rapid manual correction by nomographs and similar techniques. Expedient methods for the selection and use of optical filters, the evaluation of filter effectiveness, and the selection of optimum wavelength settings in spectrofluorometry are outlined. Author

N72-27150*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADHESION AND TRANSFER OF PTFE TO METALS STUDIED BY AUGER EMISSION SPECTROSCOPY
Stephen V. Pepper and Donald H. Buckley 1972 32 p refs Presented at 46th Natl. Colloid Symp., Amherst, Mass., 19-21 Jun. 1972; sponsored by Am. Chem. Soc.
(NASA-TM-X-68076; E-6897) Avail: NTIS HC $3.75 CSCL 07D

The adhesion and transfer of polytetrafluoroethylene (PTFE) to metals in ultrahigh vacuum has been studied using Auger emission spectroscopy. The transfer was effected both by compressive static contact and by sliding contact. The transfer observed after static contact was independent of the chemical constitution of the substrate. Electron induced desorption of the fluorine in the transferred PTFE showed that the fluorine had no chemical interaction with the metal substrate. The coefficient of friction on metals was independent of the chemical constitution of the substrate. However, sliding PTFE on soft metals such as aluminum, generated wear fragments that lodged in the PTFE and machined the substrate. Author

N72-27151*# Peninsular ChemResearch, Inc., Gainesville, Fla.
HIGHLY FLUORINATED POLYURETHANES Patent Application
Eugene C. Stump, Jr. and Stephen Eugene Rochow, inventors (to NASA) Filed 4 Apr. 1972 12 p
(Contract NAS7-746)
(NASA-Case-NPO-10767-2; US-Patent-Appl-SN-241061) Avail: NTIS HC $3.00 CSCL 07C

New polyurethanes containing a high degree of fluorine atoms are reported. The presence of the fluorine atoms in the polyurethane resins provides material having good thermal stability and chemical resistance. These polyurethanes are derived from a new hydroxy-terminated perfluoro polyether. The hydroxy terminated material is reacted with a diisocyanate to produce the polyurethanes. The polyurethanes can be used to form seals, coatings, potting material, hoses and the like. NASA

N72-27152*# Scientific Translation Service, Santa Barbara, Calif.
ON THE NATURE OF THE HYDROGEN ADSORPTION AT PLATINUM METAL ELECTRODES
M. Breiter Washington NASA Jul. 1972 21 p refs Transl. into ENGLISH from Electrochim. Acta (England), v. 7, 1962 p 25-38 (German Language)
(Contract NASw-2035)
(NASA-TT-F-14361) Avail: NTIS HC $3.25 CSCL 07B

The Pt and Ir electrodes have two surface regions with different affinities for the adsorption of H, which is strongly bound at relatively positive potentials, weakly bound at relatively negative potentials. When the fraction of the surface covered is small, the degree of coverage is proportional to the square root of H pressure for Pt, Ir, and Rh in 2.3 M H2SO4, and for Pt in certain other solutions. H is then adsorbed in the form of H atoms over the whole range of strongly bound H. The influence of anions on the adsorption of H on Pt is discussed. The adsorption of the strongly bound H on Pt and Ir and that of H

for the single range observed with Rh in H2SO4 solution can be approximately described by a Langmuir isotherm. Author

N72-27153*# Translation Consultants, Ltd., Arlington, Va.
GAS CHROMATOGRAPHY DETERMINATION OF ALCOHOLS AND MERCAPTANS
S. I. Obtemperanskaya Washington NASA Jul. 1972 5 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. 2 Khim. (Moscow), 1970 p 369-371
(Contract NASw-2038)
(NASA-TT-F-14348) Avail: NTIS HC $3.00 CSCL 07C

A method was developed for analysis of primary and secondary alcohols. The method is based on cyanethylation by acrylonitrile and gas chromatography determination of the excess of acrylonitrile. Author

N72-27154*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
ON OPTIMIZING THE TREATMENT OF EXCHANGE PERTURBATIONS
Joseph O. Hirschfelder and Daniel M. Chipman 1 Mar. 1972 16 p refs Prepared in cooperation with Calif. Univ.
(Grants NGL-50-002-001; NSF GP-23764; DA-ARO(D)-31-G179)
(NASA-CR-127265; WIS-TCI-471) Avail: NTIS HC $3.00 CSCL 07D

A method using the zeroth plus first order wave functions, obtained by optimizing the basic equation used in exchange perturbation treatments, is utilized in an attempt to determine the exact energy and wave function in the exchange process. Attempts to determine the first order perturbation solution by optimizing the sum of the first and second order energies were unsuccessful. Author

N72-27155# Bureau of Mines, Amarillo, Tex. Div. of Helium.
HELIUM: BIBLIOGRAPHY OF TECHNICAL AND SCIENTIFIC LITERATURE, 1965, INCLUDING PAPERS ON ALPHA-PARTICLES
Philip C. Tully, Emily Dowdy, and Betty G. Noe 1971 803 p refs
(BM-IC-8523) Avail: SOD $6.25 as I 28.27:8523

A bibliography is presented that contains 3,990 different citations to technical and scientific literature about helium and alpha particles, abstracted by 12 abstract service publications during 1965. Multiple classification increases tha total number of entries to more than 6,300. Helium citations are listed by 23 major classifications, alpha particles by 13. Author

N72-27156*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VARIANCE REDUCTION IN MONTE CARLO ANALYSIS OF RAREFIED GAS DIFFUSION
Morris Perlmutter 1972 7 p Presented at 8th Intern. Symp. on Rarefied Gas Dyn., Stanford, Calif., 10-14 Jul. 1972; sponsored by Stanford Univ
(NASA-TM-X-68094) Avail: NTIS HC $3.00 CSCL 07D

The present analysis uses the Monte Carlo method to solve the problem of rarefied diffusion between parallel walls. The diffusing molecules are evaporated or emitted from one of two parallel walls and diffused through another molecular species. The analysis treats the diffusing molecule as undergoing a Markov random walk and the local macroscopic properties are found as the expected value of the random variable, the random walk payoff. By biasing the transition probabilities and changing the collision payoffs the expected Markov walk payoff is retained but its variance is reduced so that the M. C. result has a much smaller error. Author

N72-27157# RAND Corp., Santa Monica, Calif.
A CSMP/360 PRECOMPILER FOR KINETIC CHEMICAL EQUATIONS
R. Lawrence Clark and Gabriel F. Groner Apr. 1972 27 p refs Submitted for publication
(Grant CA-12369)
(P-4812) Avail: NTIS HC $3.50

The CHEMCSMP program was designed to use a problem-oriented language and the power of CSMP/360 to solve problems in kinetic chemical equations, where the primary interest is in the transient states of chemical systems. Its language and computational techniques are based on those of BIOMOD, an interactive model construction and simulation system. Chemical equations are written in CHEMCSMP in a format resembling conventional chemical notation. They may be combined with other CSMP statements. CHEMCSMP is implemented via a precompiler, which translates the chemical equations into pure CSMP. An augmented function library is used to perform some of the internal computations. Author

N72-27158# Royal Aircraft Establishment, Farnborough (England).
INTERNAL PLASTICISATION OF AROMATIC POLYESTERS BY ALKYL SIDE CHAINS
W. A. Lee and Bridget Stagg Nov. 1971 16 p refs
(RAE-TR-71223; BR27730) Avail: NTIS HC $3.00

The low temperature unit for elastomeric properties is set by the glass transition temperature and may be lowered by external and internal plasticization. Internal plasticization of a polymer consists of incorporating into the structure flexible, chemically bonded groups. The polymers studied were the methyl, ethyl, propyl, butyl, hexyl, octyl, nonyl, ondecyl, and tridecyl members of a monologous series of poly 5-alkyl resorcinol isophtalates. The glass transition temperature of these isophtalate polymers were found to lie between 17 and 153 C. This shows that a polymer with a relatively rigid main chain may be internally plasticized by alkyl chains. ESRO

N72-27159# Royal Aircraft Establishment, Farnborough (England).
ARYLENE PERFLUORO ALKYLENE MODIFIED POLYSILOXANES
V. C. R. McLoughlin and Patricia A. Grattan Nov. 1971 35 p refs
(RAE-TR-71224; BR27694) Avail: NTIS HC $3.75

Synthesis of alpha, omega bis (m-(hydroxy dimethyl silyl)phenyl) perfluoro alkanes is described. Polycondensations catalyzed by hexyl ammonium 2-ethyl-hexandate give the corresponding high molecular weight polysiloxanes. These polymers are elastomeric and more thermally stable than polydimethyl siloxane on a weight-loss basis. A vulcanizate of the polymer with (CF3)2 units is stronger than a conventional methyl silicone rubber vulcanizate. Possible modifications to reduce the glass transition temperature and help in vulcanization are discussed. ESRO

N72-27160# Naval Research Lab., Washington, D.C.
OBSERVATION OF X-RAY LINES FROM HIGHLY IONIZED IRON IN A LASER PLASMA
E. V. Aglitskii, V. A. Boiko, S. M. Zakharov, G. V. Sklizkov, and A. N. Federov 24 Mar. 1972 7 p refs Transl. into ENGLISH from Akad. Nauk SSSR. Fiz. Inst. Kratki Soobshch. po Fizike (USSR), no. 12, 1971 p 36-40
(AD-739255; NRL-Trans-1238) Avail: NTIS CSCL 07/4

Investigation of the energy structure of multicharged ions formed in a hot laser plasma requires progression from the vacuum ultraviolet to the soft X-ray region of the spectrum, as a large part of the transitions of astrophysical interest lie precisely in this range. In the apparatus described in the report for analyzing the soft X-ray radiation of a laser plasma, a convex crystal was used as the dispersing element. A spectrogram was obtained containing about 40 lines of highly ionized iron in the region of 10-16A. GRA

N72-27161# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMOPHYSICAL PROPERTIES OF GASES, SELECTED ARTICLES
6 Dec. 1971 114 p refs Transl. into ENGLISH from the publ. "Teplofizicheskiye Svoystva Gazov" Moscow, Nauka, 1970 p 9-13, 24-25, 31-50, 60-63, 67-70,141-151, and 153-156
(AD-738737; FTD-MT-24-113-71) Avail: NTIS CSCL 07/4

Contents: The thermal conductivity of neon, krypton, and xenon; Thermal conductivity of the vapors of alkali metals with a calculation of dissociation; The thermal conductivity of krypton up to 1200 K; Calculation of the thermal conductivity of gas mixtures; Dependence of the thermal conductivity of helium on pressure; Thermal conductivity of gases by the reflected-wave method; Dependence of the coefficient of thermal conductivity of gases on temperature; Viscosity of hydrogen; Viscosity of gases at high pressures; Virial coefficients and thermodynamic properties of dissociating hydrogen and the vapors of alkali metals; The elasticity of potassium vapor; The pressure of saturated lithium vapor (1200-2160 K); Saturated vapors of cesium; Thermodynamic properties of neon, argon, krypton, and xenon in the single-phase area. Author (GRA)

N72-27162# IIT Research Inst., Chicago, Ill.
SUBMICRON SEPARATION AND DATA Literature Survey, 16 Apr. - 31 Oct. 1971
Reg Davies, Don K. Werle, and Walter J. Wnek 31 Oct. 1971 364 p refs
(Contract F33657-71-C-0859; ARPA Order 1702)
(AD-739197; IITRI-C6239-A005-1) Avail: NTIS CSCL 07/4

The objective of the project is to develop the methods, procedures, and equipment required to isolate individual submicron particles from an agglomerated matrix for analysis by various techniques. The particles of prime interest are those submicron particles found in the atmosphere as a result of industrial air pollution. The report presents a review of this area and contains over 1100 references. The topics reviewed include: Basic concepts of submicron separation; Atmospheric aerosols (Properties, sources, nature of, size and shape); Adhesion of atmospheric particles (Forces, mechanism and methods of measuring adhesion and separation forces, indexes of dispersion); Mathematical models of adhesion and agglomeration; Methods of sampling, collecting and analyzing submicron particles (in air, in liquid). Author (GRA)

N72-27163# Aerospace Corp., El Segundo, Calif.
VACUUM THERMAL DECOMPOSITIONS OF THE NITRATE SALTS OF HYDRAZINE Technical Report, Mar. - Aug. 1971
Hideyo H. Takimoto, Peter Breisacher, Genevieve C. Denault, and William A. Hicks 31 Jan. 1972 20 p refs
(Contract F04701-71-C-0172)
(AD-739187; TR-0172(2210-10)-3; SAMSO-TR-72-63) Avail: NTIS CSCL 07/2

The vacuum thermal decompositions of the combustion intermediates from the reaction of N2O4 with N2H4 have been investigated. The identity and concentrations of the evolved gaseous products from mononitrate and dinitrate salts of hydrazine as well as ammonium nitrate were determined at successive temperatures until the thermolyses were completed, with a mass spectrometer and differential thermal analyzer. Author (GRA)

N72-27164# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A SIMPLE TECHNIQUE FOR GENERATING NITROGEN ATOMS
Kevin J. White, Cornelius U. Morgan, and Eli Freedman Mar. 1972 19 p refs
(AD-739520; BRL-MR-2158) Avail: NTIS CSCL 07/4

It has been found that up to 1% nitrogen atoms can be generated by passing nitrogen gas over the heated filaments of a conventional 1000 watt projection lamp. It appears that the filaments must attain a minimum voltage and temperature for the production of nitrogen but these conditions can readily be achieved by a variable voltage transformer. Author (GRA)

N72-27165# Tetra Tech, Inc., Pasadena, Calif.
STUDIES OF EXCITED HYDROGEN IN RELATION TO ADVANCED PROPULSION Final Report, 16 Mar. 1969 - 15 Mar. 1972
John M. Flournoy Mar. 1972 27 p refs
(Contract F44620-69-C-0080; AF Proj. 9750)
(AD-739524; TETRAT-P-72-155-3; AFOSR-72-0504TR) Avail: NTIS CSCL 07/4

The report summarizes the results of research on the kinetic and energetic behavior of vibrationally excited hydrogen molecules. Excited hydrogen was generated in a microwave discharge in a low-pressure flow system. A detection method for the vibrationally excited hydrogen was developed in which gaseous hydrogen cyanide is injected into the hydrogen stream and becomes vibrationally excited through collisions with the excited hydrogen molecules; the excited HCN then emits infrared radiation at 3.0 microns. The kinetic results indicate that the most important relaxation mechanism of the vibrationally excited hydrogen is by reaction with hydrogen atoms. An automated catalytic isothermal calorimeter with direct read-out was developed for detection of the excited species. Hydrogen-atom concentrations were determined successfully. Author (GRA)

N72-27166# Monsanto Research Corp., Dayton, Ohio.
TRACE ANALYSIS FOR METALS IN AEROSPACE MATERIALS BY GAS CHROMATOGRAPHY Final Technical Report
William D. Ross, Larry C. Hansen, and William G. Scribner Wright-Patterson AFB, Ohio ARL Dec. 1971 237 p refs
(Contract F33615-69-C-1062; AF Proj. 7023)
(AD-739865; ARL-71-0285) Avail: NTIS CSCL 07/2

Methods were developed for the ultratrace determination of certain metals in various media by chelation and gas chromatography using electron capture detection. Analysis for traces of cobalt in water and liver extract are described. The conversion of cobalt from cyanocobalamine to cobalt heptafluorodmethyloctanedionate followed by analysis by the gas chromograph was achieved. Analytical methods for the analysis of beryllium in particulate matter collected from air and fly ash using chelation-gc methods were developed. A method for the detection of beryllium in urine of workers exposed to fly ash is described. Solvent extraction methods for the extraction of chromium employing methanol as a reaction medium for the relatively rapid formation of chromium heptafluorodimethyloctanedione are described. Chromium has been determined with 90% efficiency in both whole blood and blood plasma. Preliminary experiments on the conversion of hydrocarbon-soluble or suspended particulate iron compounds to Fe(tfa)3 are reported. Author (GRA)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N72-27167*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
THE USE OF THE THREE DIMENSIONAL COHERENCY MATRIX IN ANALYZING THE POLARIZATION PROPERTIES OF PLANE WAVES
Joseph D. Means Jan. 1972 29 p refs Prepared for JPL
(Contract NAS7-100; Grant NGR-05-007-276; Contract JPL-950403)
(NASA-CR-127271; Publ-1007) Avail: NTIS HC $3.50 CSCL

20N

A technique for analyzing the polarization properties of plane waves is developed which offers a number of advantages over methods currently used in the analysis of both ground and satellite observations of waves. This technique reduces the computations required to find the wave normal vector, is less sensitive to common noise sources, and is amenable to analog implementation. This technique is applied specifically to the analysis of a proton whistler, but may also be used in most studies of ULF, ELF, and VLF magnetic wave phenomena. Author

N72-27168*# Scientific Management Systems, Inc., Bethesda, Md.
DESIGN STUDY OF A LOW BIT RATE TRANSMITTER AND SIMULATOR
F. S. Zusman and P. J. Steen 13 Jan. 1972 63 p refs
(Contract NAS5-11480)
(NASA-CR-122435) Avail: NTIS HC $5.25 CSCL 09F

The results achieved toward developing a baseline communications channel model for studying low bit rate telemetry transmissions from Venus Planetary Explorer spacecraft are presented. The overall communications systems model, discrete channel model, input signal generation, and signal acquisition model are discussed. Discrete Fourier transform considerations, sampling routines, and flow charts are included. F.O.S.

N72-27169*# National Aeronautics and Space Administration, Washington, D.C.
SECOND SCIENTIFIC TECHNICAL CONFERENCE ON RADIO COMMUNICATION
Apr. 1972 13 p Transl. into ENGLISH of the Table of Contents of "Vtoraya Nauchnoteknicheskaya Konferentsia po Kosmicheskaya radiosvyazi" Moscow, Nauka Press, 1971
(NASA-TT-F-14406) Avail: NTIS HC $3.00 CSCL 17B

Papers that were presented at a radio communication conference are listed by the title and author. Papers were given under seven major topics. These were: (1) radio wave propagation, (2) systems of satellite communication and electromagnetic compatibility problems, (3) synchronization systems, (4) communication problems with extraterrestrial civilizations, (5) freedom from interference of discrete methods of information transmission over space communication links, (6) telemetry, and (7) apparatus design for space communication systems. J.A.M.

N72-27170*# Scientific Translation Service, Santa Barbara, Calif.
RELATIONSHIP BETWEEN OUTGOING MICROWAVE RADIATION AND THE SURFACE OF THE SEA (BASED ON DATA OBTAINED FROM THE KOSMOS-243 SATELLITE
L. M. Martsinkevich and D. T. Matveyev Washington NASA May 1972 19 p refs Transl. into ENGLISH from Meteorol. Gidrol. (USSR), no. 8, 1971 p 50-59
(Contract NASw-2035)
(NASA-TT-F-14400) Avail: NTIS HC $3.00 CSCL 17B

A combined analysis of data on radiometric satellite wind waves is performed. It is demonstrated that a relationship exists between the brightness temperature and the sea-surface state. This relationship serves as a basis for using radiometric information with the aim of finding storm zones in oceans. Author

N72-27171*# National Aeronautics and Space Administration, Washington, D.C.
INTASAT SATELLITE PROJECT: SPECIFICATION OF THE CODIFICATION UNIT DESIGN
Jan. 1972 18 p Transl. into ENGLISH from "Intasat Proyecto de Satelite. Especificacion de Diseno de la Unidad de Codificacion" Inst. Nacional de Tec. Aeroespacial, Esteban Terradas, Serrano 43, Madrid, Report DHM-11440, editon 2, Sep. 1971 20 p
(NASA-TT-F-13899; DHM-11440) Avail: NTIS HC $3.00 CSCL 09F

The codification unit receives data from definite satellite points in digital or analog form. All these data are codified in words of 8 bits and arranged in a PCM format which will be transmitted in real time by the telemetry transmitter. Author

N72-27172*# Scientific Translation Service, Santa Barbara, Calif.
A SIMPLE METHOD FOR ALL PURPOSE CODING OF A SOURCE OF INDEPENDENT MESSAGES
V. F. Babkin Washington NASA May 1972 8 p refs Transl. into ENGLISH from Chetvertyy Simpozium po Probl. Izbytochnosti v Inform. Systemakh (Leningrad), v. 1, 1970 p 30-36
(Contract NASw-2035)
(NASA-TT-F-13895) Avail: NTIS HC $3.00 CSCL 17B

A structural data coding method is described which is based on numbering binary sequences. The advantages of the new method over previous ones are enumerated. Author

N72-27173*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
MULTIPLE BEAM ANTENNA SYSTEM Final Report
Paul J. Byrnes May 1972 79 p
(Contract NAS1-10839)
(NASA-CR-112102; LMSC/D156879) Avail: NTIS HC $6.00 CSCL 17B

Using a computer program which plots beams from antennas located on synchronous satellites onto the earth's surface, several circular and elliptical reflectors were analyzed for pattern coverage. The reflectors considered were circular paraboloid and elliptical shaped. Author

N72-27174*# Texas Univ., Austin. Millimeter Wave Group.
ATS-5 SIGNAL CHARACTERISTICS AT 15.3 GHz AND RELATED EXPERIMENTS AT 15 AND 35 GHz. PART 1: BASIC FEATURES OF THE EXPERIMENTS AND PRIMARY RESULTS Final Report
Archie W. Straiton [1972] 18 p refs
(Contract NAS5-10387)
(NASA-CR-122438) Avail: NTIS HC $3.00 CSCL 17B

The results are presented of observations by the University of Texas of the 15.3 GHz experiment associated with the ATS-5 satellite and of related experiments designed to provide information on earth-satellite communication links at 15.3 and 31.65 GHz. The 15.3 GHz transmissions were observed at Austin, Texas over an eighteen month interval primarily during periods of rain. Measurements were also made at Mount Locke, near Fort Davis, Texas but only for a period of two months. Essentially continuous measurements were made at Austin, Texas of the sky temperature at 35 GHz looking in the direction of the ATS-5 satellite over an interval of four months. Point-to-point transmissions over the earth's surface at 15 and 35 GHz and various meteorological parameters were studied as possible means of predicting performance over a satellite-earth path. Author

N72-27175# Joint Publications Research Service, Arlington, Va.
STUDY OF A SPIRAL GROOVE DELAY SYSTEM
D. I. Voskresenskiy and R. A. Granovskaya 29 Jun. 1972 8 p refs Transl. into ENGLISH from Elektromagnitnyye Zamedlyayushchiye Sistemy, Tr. Inst. Vyp. 125 Moskovskiy Ordena Lenina Aviats. Inst. Imeni Sergo Ordzhonikidze (USSR), no. 125, 1960 p 98-103
(JPRS-56385) Avail: NTIS HC $3.00

An experimental study of a spiral groove delay system for the centimeter wave band was made. Figures and graphs are used to show the physical and electrical characteristics of the system. Author

N72-27176*# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
GENERALIZED CHARACTERISTICS METHOD FOR ELASTIC WAVE PROPAGATION PROBLEMS
M. Ziv [1972] 27 p refs Sponsored in part by Bat-Sheva de

Rothschild Fund for the Advancement of Sci. and Tech. Prepared for JPL
(Contract NAS7-100)
(NASA-CR-127122; TAE-147) Avail: NTIS HC $3.50 CSCL 20N

Characteristic equations are derived in generalized curvilinear coordinates. Linear elastic, isotropic, and homogeneous constitutive equations have been used in the derivation. The generalized characteristic equations readily lend themselves to any requirements of space dimension and geometry. A simple boundary value problem is solved to indicate the applicability of these equations. Author

N72-27177*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE 200 WATT SHF TRANSMITTER EXPERIMENT PACKAGE
R. Alexovich 1972 10 p refs Proposed for presentation at Natl. Telecommun. Conf., Houston, Tex., 4-6 Dec. 1972; sponsored by Inst. of Elec. and Electron. Engr.
(NASA-TM-X-68106; E-7036) Avail: NTIS HC $3.00 CSCL 17B

A 200 watt SHF transmitter experiment package is discussed that incorporates a traveling wave tube utilizing a multistage depressed collector for efficiency enhancement. This experiment is being developed for flight testing on the CTS (Communications Technology Satellite). Author

N72-27178*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
METHOD AND APPARATUS FOR DECODING COMPATIBLE CONVOLUTIONAL CODES Patent Application
George D. Doland, inventor (to NASA) Filed 28 Jun. 1972 25 p Sponsored by NASA
(NASA-Case-MSC-14070-1; US-Patent-Appl-SN-266940) Avail: NTIS HC $3.25 CSCL 17B

The invention described relates to learning decoders for decoding compatible convolutional codes. The decoder decodes signals encoded by a convolutional coder and allows performance near the theoretical limit for coded data systems. The decoder includes a sub-bit shift register in which the received sub-bits are entered after regeneration and shifted in synchronization with a clock signal recovered from the received sub-bit stream. The received sub-bits are processed by a sub-bit decision circuit, entered into a sub-bit shift register, decoded by a decision circuit, entered into a data shift register, and updated to reduce data errors. The bit decision circuit utilizes stored sub-bits and stored data-bits to determine subsequent data-bits. Data errors are reduced by using at least one update circuit. NASA

N72-27179# Joint Publications Research Service, Arlington, Va.
INFORMATION AND CYBERNETICS
A. D. Ursul 11 Jul. 1972 12 p refs Transl. into ENGLISH from Priroda (Moscow), no. 5, 1972
(JPRS-56465) Avail: NTIS HC $3.00

A discussion is presented on the development of cybernetics, communication, information theory, and control. Author

N72-27180# Lockheed Missiles and Space Co., Palo Alto, Calif.
SIGNAL RECEPTION ON THE KOSMOS-381 FROM THE MAGNETICALLY CONJUGATE DOMAIN
E. A. Benediktov, G. V. Bukin, Iu. V. Kushnerevskii, S. N. Matiugin, N. P. Mozerov, Iu. K. Perekhvatov, and M. D. Fligel [1972] 3 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), 10, no. 2, 1972 p 302-303
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The ground based reception of artificial satellite signals from the magnetically conjugate domain is investigated. The measurements were made at a point where the satellite and waveguide duct intersect outside the lower ionosphere. The Cosmos-381 satellite with an ionospheric station onboard was used for the experiment. The ionospheric station operated in the fixed frequency mode and had the following parameters: transmitter pulse power of approximately 100W, probing pulse duration of approximately 150 microns, and pulse repetition rate of approximately 48 Hz. The station operated at the frequencies of 2.0, 3.2, 5.6, 8.6, 10.4, and 12.8 MHz. Author

N72-27181# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
STATISTICAL DESCRIPTIONS OF LINKING STRATEGIES IN MULTIPLE RADAR TRACKING [STATISTISCHE BESCHREIBUNG VON VERKNUEPFUNGSSTRATEGIEN BEI DER MULTI-RADAR-BEOBACHTUNG]
G. vanKeuk and W. Pandikow Jul. 1970 44 p refs In GERMAN
(Rept-130) Avail: NTIS HC $4.25

The statistical computation of linking strategies in multiple radar surveillance using monoradars and based on Markov chains is presented. It is found that for statistical observation the effects of several linking strategies, which are especially complex due to multiple coverage, can be best described by Markov chains. In a local treatment of the problem the mean idle time of a track is a good measure for the power of a linking algorithm. The theoretical effort is simplified to the calculation of single transition possibilities, while the numerical computation can be dealt with by standard programs. The method is explained using selected strategies and numerical results are commented upon. ESRO

N72-27182# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
LINEAR PREDICTION AND ALPHA-BETA TECHNIQUE [LINEARE PRAEDIKTION UND ALPHA-BETA-VERFAHREN]
G. vanKeuk Oct. 1970 80 p refs In GERMAN; ENGLISH summary
(Rept-154) Avail: NTIS HC $6.00

The problem of minimizing the expectation volume is investigated starting from the concept of a linear, time independent translation invariant N-point predictor. No special assumptions are made concerning the correlation of accelerations of the tracked targets. The influence of localization number taken into account for prediction is demonstrated. Results are compared with the well-known alpa-beta technique. ESRO

N72-27183# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
A SURVEY OF A PHASED ARRAY RADAR SYSTEM UNDER DEVELOPMENT IN THE FFM [DIE KONZEPTION EINES VOM FFM GEPLANTEN ELEKTRONISCHEN RADARSYSTEMS]
W. D. Wirth Sep. 1970 34 p refs In GERMAN; ENGLISH summary
(Rept-162) Avail: NTIS HC $3.75

A survey is given of the design of an electronically controlled phased array radar system. The simultaneous performance of search and tracking functions is provided. All functions may be adapted to various conditions. The design parameters are derived from the performance specifications. The system range is chosen as 200 km. All units for producing and processing signals are discussed, especially the separate construction of the transmit and receive antennas, and the generation of transient power by single amplifiers for each radiating element. The necessity for a process computer for control and data buffering is established. ESRO

N72-27184# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
TARGET TRACKING USING KALMAN FILTERING: AN APPLICATION TO PHASED ARRAY RADAR [ZIELVERFOLGUNG NACH KALMAN-ANWENDUNG AUF ELEKTRON-

ISCHES RADAR]
G. vanKeuk Apr. 1971 87 p refs In GERMAN; ENGLISH summary
(Rept-173) Avail: NTIS HC $6.50

A tracking procedure based on Kalman filtering techniques is derived theoretically. Following this method, prediction and filtering problems are solved directly for maneuvering targets without Doppler information. Numerical results are presented and discussed. Author (ESRO)

N72-27185# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
EVALUATION OF RADAR DATA RECORDED ON MAGNETIC TAPE BY THE MEANS OF THE RADICORD. GROUND AND WEATHER CLUTTER, NEUNKIRCHEN/GT. MALVERN
K. vonSchlachta and W. D. Wirth Oct. 1970 46 p ref
(Rept-165) Avail: NTIS HC $4.50

The statistical analysis is presented of some aspects of ground and weather clutter recorded at Neunkirchen (Germany) and Great Malvern (England). The data was digitized and recorded on magnetic tape. The clutter is represented by the power spectral density, and evaluated out of the auto and cross correlation functions of the components. By sampling the radar echoes, the radar area is divided into rings of constant range. The echo vectors within the recorder's measuring gate are stored in a two-dimensional matrix with M range elements (rings) and N bearing elements (sweeps). ESRO

N72-27186# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
EVALUATION OF RADAR DATA RECORDED ON MAGNETIC TAPE BY THE MEANS OF THE RADICORD. RADAR SAINTE-BAUME
W. Buehring and K. vonSchlachta 1971 64 p refs Sponsored in part by the European Organ. for the Safety of Air Navigation
(Rept-175) Avail: NTIS HC $5.25

The statistical analysis is presented of the properties of targets and clutter from recorded coherent radar echoes at Ste. Baume (France). Many scans of a flight have been recorded by manual tracking with a measuring window. Several echoes of the same target are received by means of the antenna pattern. This sequence of echoes is processed and recorded on magnetic tape. The appropriate filter function for target detection can be calculated from the deviation of amplitude and phase shift. The following results are summarized for the investigated class of magnetron L-band surveillance radars: aircraft differ apart from their cross section in the echo variances corresponding to different kinds of propulsion, and ground clutter measurements show very little difference for different radar sites. ESRO

N72-27187# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
THE SEQUENTIAL TEST FOR MULTIPLE RANGE BINS AND ITS REALIZATION [DER SEQUENTIALTEST FUER EINE VIELZAHL VON ENTFERNUNGSELEMENTEN UND SEINE REALISIERUNG]
W. D. Wirth Aug. 1971 68 p refs In GERMAN; ENGLISH summary
(Rept-177) Avail: NTIS HC $5.50

Radar target discovery with sequential tests for multiple range elements and its realization with a reduction of test length were investigated. An independent test of all range elements for an antenna lobe position, as well as a common test by averaging of test functions over all range elements (Marcus and Swerling test) were compared regarding test duration. Several possibilities, under consideration of the range dependence for shortening test duration, are investigated. The investigations lead to a weighted sum of individual test functions as an overall test function. The noticeable reduction of the test length justifies a higher complexity of the realization. Problems of unknown and fluctuating target signals are treated. ESRO

N72-27188# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany). Abetilung fuer Fernmeldewesen.
PREDICTING AND OPTIMIZING SATELLITE COMMUNICATION PERFORMANCE UNDER UNFAVOURABLE GEOGRAPHIC AND ATMOSPHERIC CONDITIONS
H. J. Albrecht Nov. 1971 35 p refs Presented at the IEEE-EUROCON 71, Lausanne, Switz., 18-22 Oct. 1971
(Contract T-832-1-203)
(Rept-6-71) Avail: NTIS HC $3.75

The prediction of communication satellite performance is dealt with under limited fading conditions due to low elevation angles. Atmospheric effects such as scintillation at lower frequencies and variable tropospheric scattering at higher frequencies are considered. Criteria for optimizing performance in the limiting ranges VHF and SHF above 10 GHz, and aspects of frequency sharing are presented. ESRO

N72-27189# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
PREDICTION OF IONOSPHERIC SCINTILLATIONS FOR SATELLITE SIGNALS IN COMMUNICATIONS AND NAVIGATION
H. J. Albrecht Nov. 1971 19 p refs Presented at the IIC Conf., Genoa, 12-16 Oct. 1971
(Contract T-91346)
(Rept-7-71) Avail: NTIS HC $3.00

The application of satellites as radio relay terminals to the controlled surveillance of aircraft flying over the North Atlantic is presented. Up to 1 GHz the scintillations experienced by signals on the paths between space and ground may interfere with a satellite link, depending on the geographical region. In order to predict enhanced occurrences and effects of such scintillation, to be expected in the area used by airliners, a method for the prediction of scintillation index is described, based on data correlation between scintillation occurrence and spread F. It is concluded that the prediction method presented is universally applicable for the determination of the absolute value of scintillation index at any place on the earth's surface if fundamental ionospheric parameters such as charts of critical frequencies and maximum usable frequency are available. ESRO

N72-27190# Syracuse Univ., N.Y. Dept. of Electrical and Computer Engineering.
IMPROVED PROGRAMS FOR ANALYSIS OF RADIATION AND SCATTERING BY CONFIGURATIONS OF ARBITRARILY BENT THIN WIRES
Dah-Cheng Kuo and Bradley J. Strait 15 Jan. 1972 52 p refs
(Contract F19628-68-C-0180)
(AD-739203; SR-15; AFCRL-72-0051) Avail: NTIS CSCL 09/5

Improved user-oriented computer programs are presented and described for analyzing the electromagnetic behavior of arbitrarily bent thin-wire antennas and scatterers. A given problem can involve several wires of different shapes and radii and the wires can be excited or loaded at arbitrary points along their lengths. Matrix methods are used with the method of moments to compute various quantities of engineering interest. For radiation problems these include current distributions, input impedances, and specified far-field patterns and near-field distributions. For scattering problems the current is again calculated along with specified scattered field and bistatic radar cross-section patterns. Particular emphasis is given to required data input, and illustrative examples are included. Author (GRA)

N72-27191# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LOW-CAPACITY MICROWAVE COMMUNICATION LINKS
F. P. Lipsman 26 Oct. 1971 16 p refs Transl. into ENGLISH from the monograph "Antenny i Antennye Ustroistva, Sbornik Statei" 1970 p 80-84
(AD-738694; FTD-HT-23-711-71) Avail: NTIS CSCL 17/2

The author discusses various uses for low-capacity microwave links (LCML). Unlike multichannel (long-line) systems, LCML's

are found in both fixed (stationary) and transportable versions, including the highly mobile kind installed on a variety of motor vehicles. An essential LCML characteristic is that these are, as a rule, single-trunk links capable of being rapidly returned over a wide frequency band, while in most cases multichannel radio-relay lines operate exclusively on fixed frequencies assigned to each trunk during the manufacturing stage at the plant. Author (GRA)

N72-27192# School of Aerospace Medicine, Brooks AFB, Tex.
DEVELOPMENT OF BINAURAL TIME-DELAY APPARATUS FOR IMPROVING INTELLIGIBILITY OF SPEECH Progress Report, Jul. 1970 - Jul. 1971
Donald C. Gasaway Dec. 1971 17 p refs
(AF Proj. 7755)
(AD-738628; SAM-TR-71-46) Avail: NTIS CSCL 17/2

A variety of electroacoustic instruments and devices have evolved in attempts to improve the perception and discrimination of aural signals and messages. The report describes instrumentation that delivers binaurally time-delayed signals that tend to enhance the intelligibility of speech signals delivered to subjects. The electroacoustic device can be used to improve the intelligibility of desired signals when immersed in masking (interfering) noise. The device used to achieve binaural time delays encompasses completely variable delays ranging from 0 (in phase) to 1500 msec. This device has proved of considerable value in situations where desired speech signals coexist with masking or other interfering noises, such as voice recordings obtained within cockpits of aircraft. Details of the device and practical applications of binaural time-delay phenomenon are discussed. Author (GRA)

N72-27193# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ELECTROMAGNETIC SCATTERING FROM TURBULENT BOUNDARY LAYERS
Richard D. Ruquist 21 Jan. 1972 19 p refs
(Contract F19628-70-C-0230; ARPA Order 600)
(AD-738632; ESD-TR-72-30; TN-1972-6) Avail: NTIS CSCL 20/14

The incoherent scattering cross section of an underdense turbulent boundary layer adjacent to both a perfectly conducting ground plane and a perfectly conducting cylindrical surface is determined. It is found that the effect of the metallic surfaces on scattering from the turbulent plasma depends on the thickness of the boundary layer and the characteristics of the incident electromagnetic waves. For optically thin boundary layers, a plane metallic surface will enhance scattering in one linear polarization by up to 12 dB while eliminating scattering in the other polarization. Author (GRA)

N72-27194# Harry Diamond Labs., Washington, D.C.
A LOW-COST VERSATILE SUBCARRIER OSCILLATOR
Robert E. Elmore Dec. 1971 21 p
(DA Proj. 1W2-6301-A-301)
(AD-739481; HDL-TM-71-44) Avail: NTIS CSCL 09/6

The report describes the work done on two different types of low-cost, temperature-compensated, telemetry subcarrier oscillators, for high-g telemetry applications. One type is a standard dual voltage-controlled oscillator designed to operate in the plus or minus 15 percent deviation channels A through H. Six of this type were built and tested. The other type is a wide-band voltage-controlled oscillator. In addition, a simple pulse-averaging discriminator was designed and built to complement the wide-band oscillator. The wide-band system provides a 100 Hz to 100 kHz information bandwidth.
Author (GRA)

N72-27195# Army Missile Command, Redstone Arsenal, Ala. Advanced Sensors Directorate.
PULSE COMPRESSION SIDE-LOBE CLUTTER REDUCTION
Charles J. Kiss 20 Jan. 1972 54 p refs
(DA Proj. 1X2-63302-D-212)
(AD-739512; RE-TR-72-2) Avail: NTIS CSCL 17/9

The report presents the results of an investigation of the effects of frequency weighting the compressed linear-FM spectra in an attempt to suppress or redistribute the side-lobe clutter which result from the matched filtering process. Most importantly, the rectangular linear-FM spectra approximation is deferred and the exact Fresnel spectra are used in the computations.
Author (GRA)

N72-27196# Atlantic Research Corp., Alexandria, Va. Electronics and Communications Div.
IPP-1 USER MANUAL. VOLUME 1, PART 1 Final Technical Report, Dec. 1968 - Jul. 1971
William G. Duff, Frank E. Ferrante, Thomas E. Baldwin, Jr., and William P. Seneker Griffiss AFB, N. Y. RADC Jan. 1972 259 p refs
(Contract F30602-69-C-0051)
(AD-739526; RADC-TR-71-300-Vol-1-Pt-1) Avail: NTIS CSCL 20/14

The IPP-1 User Manual summarizes all of the contractual efforts relating to the electromagnetic interference prediction and analysis process which was developed under the sponsorship of Rome Air Development Center Project 4540. The primary objective of the User Manual is to provide the interference analyst with a detailed description of and operating instructions for the automated analyses process for evaluating the electromagnetic compatibility between radiating and receiving equipments within an environment. Information contained in the IPP-1 User Manual includes a general discussion of the analysis process, a summary of analysis requirements, methods and techniques, detailed program descriptions and a discussion of the interpretation of analysis results. The major programs included in this report are: data management, rapid cull, frequency cull, detailed analysis, and frequency band analysis. Author (GRA)

N72-27197# Atlantic Research Corp., Alexandria, Va. Electronics and Communications Div.
IPP-1 USER MANUAL. VOLUME 1, PART 2 Final Technical Report, Dec. 1968 - Jul. 1971
William G. Duff, Thomas E. Baldwin, Jr., Frank E. Ferrante, and William P. Seneker Griffiss AFB, N. Y. RADC Jan. 1972 519 p refs
(Contract F30602-69-C-0051)
(AD-739527; RADC-TR-71-300-Vol-1-Pt-2) Avail: NTIS CSCL 20/14

The document, volume 1, part 2 of the IPP-1 User Manual contains a general discussion of the analysis program, a summary of analysis requirements, methods and techniques, detailed program descriptions and a discussion of the interpretation of analysis results on electromagnetic compatability. The major topics included in this report are: propagation, frequency-distance, intermodulation, adjacent channel, and field strength-power density. GRA

N72-27198# Atlantic Research Corp., Alexandria, Va. Electronics and Communications Div.
IPP-1 USER MANUAL. VOLUME 2, PART 1 Final Technical Report, Dec. 1968 - Jul. 1971
William G. Duff, Frank E. Ferrante, Thomas E. Baldwin, Jr., and William P. Seneker Griffiss AFB, N. Y. RADC Jan. 1972 290 p
(Contract F30602-69-C-0051)
(AD-739528; RADC-TR-71-300-Vol-2-Pt-1) Avail: NTIS CSCL 20/14

The IPP-1 User Manual summarizes all of the contractual efforts relating to the electromagnetic interference prediction and analysis process which was developed under the sponsorship of Rome Air Development Center Project 4540. Information contained in the IPP-1 User Manual includes a general discussion of the analysis process, a summary of analysis requirements, methods and techniques, detailed program descriptions and a discussion of the interpretation of analysis results. The major programs included in this report are data management, rapid cull, frequency cull, and detailed analysis. Author (GRA)

N72-27199# Atlantic Research Corp., Alexandria, Va. Electronics and Communications Div.
IPP-1 USER'S MANUAL. VOLUME 2, PART 2 Final Technical Report, Dec. 1968 - Jul. 1971
William G. Duff, Frank E. Ferrante, Thomas E. Baldwin, Jr., and William P. Seneker Griffiss AFB, N. Y. RADC Jan. 1972 348 p
(Contract F30602-69-C-0051)
(AD-739529; RADC-TR-71-300-Vol-2-Pt-2) Avail: NTIS CSCL 20/14

The major programs included in the report are the continuation of frequency cull, detailed analysis, and frequency band analysis. Author (GRA)

N72-27200# Atlantic Research Corp., Alexandria, Va. Electronics and Communications Div.
IPP-1 USER MANUAL. VOLUME 2, PART 3 Final Technical Report, Dec. 1968 - Jul. 1971
William G. Duff, Frank E. Ferrante, Thomas E. Baldwin, Jr., and William P. Seneker Griffiss AFB, N. Y. RADC Jan. 1972 478 p
(Contract F30602-69-C-0051)
(AD-739530; RADC-TR-71-300-Vol-2-Pt-3) Avail: NTIS CSCL 20/14

The major programs included in the report are: propagation, frequency-distance, intermodulation, adjacent channel, and field strength-power density. Author (GRA)

N72-27201# Michigan Univ., Ann Arbor. Engineering Psychology Lab.
APPLICATION OF RESEARCH ON COGNITION TO MAN-MACHINE SYSTEM DESIGN Final Report
Ward Edwards 31 Mar. 1972 53 p refs
(Contract N00014-71-C-0322)
(AD-739708; Rept-010342-1-F) Avail: NTIS CSCL 05/8

The report reviews the ONR Conference on Applications of Decision and Information Processing Research to the Design of Command and Control Systems. Author (GRA)

N72-27202# Institute for Telecommunication Sciences, Boulder, Colo. Inst. for Telecommunication Science.
VLF-LF IONOSPHERIC CHANNEL CHARACTERISTICS
J. H. Crary and F. K. Steele Jan. 1972 101 p refs
(AD-739686; OT/ITSTM-73) Avail: NTIS CSCL 20/14

Calculated phase and amplitude of the significant components of the total fields from 10 to 60 kHz for models of the normal day and night D-region are presented. Estimates of VLF-LF time delays and dispersions of the dominant components (modes and hops) are made for a highly conducting ground and no magnetic field for reasonable models of the normal day and night model ionospheres. Amplitude data taken on 22.3, 24, and 37.225 kHz during periods of wide and rapid fluctuations are given and discussed in terms of fading rates and signal strength distributions. Available results on the effect of rough sea on phase and amplitude of VLF signals received below the sea surface are presented. Author (GRA)

N72-27883 Joint Publications Research Service, Arlington, Va.
OVER TELEMETRY CHANNELS
V. Borisov *In its* Docking Training and Telemetry 11 Jul. 1972 p 8-13 (For availability see N72-27881 18-30)

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N72-27203 Japan Broadcasting Corp., Tokyo. Technical Research Labs.
MULTIPLEX TRANSMISSION OF TIME-AXIS CONVERSION SIGNALS AND ITS DEVICES USING CAPACITOR MEMORY CONTROLLED BY MOS IC
Soichi Iwamura and Shinichi Ono Dec. 1971 31 p refs
(Rept-18) Copyright. Avail: Issuing Activity

The merits and demerits of time-axis-compression multiplex transmission are compared with those of other multiplex transmissions, such as SSB, parallel FM, PAM, and PCM. The spectra of compression signal and waveforms deformed by passing through a low-pass filter are discussed. The number of multiplexable channels and the necessary bandwidth are calculated. Tentative memories are needed for the time-axis--compressor and expander so that analog memories were adopted using charge-storage of capacitors controlled by MOS MSI. The MOS MSI was fabricated, it is a package consisting of 32 gates of normally-off n channel device on one chip, 42 gates of normally-off p channel on another, and 10 switches with a 10-stage shift register. Author

N72-27204*# Northrop Services, Inc., Huntsville, Ala.
UNSUPERVISED CLASSIFICATION OF REMOTE MULTISPECTRAL SENSING DATA
M. Y. Su 15 Apr. 1972 102 p refs
(Contract NAS8-27364)
(NASA CR-123799; TR-220-1075) Avail: NTIS HC $7.25 CSCL 09D

The new unsupervised classification technique for classifying multispectral remote sensing data which can be either from the multispectral scanner or digitized color-separation aerial photographs consists of two parts: (a) a sequential statistical clustering which is a one-pass sequential variance analysis and (b) a generalized K-means clustering. In this composite clustering technique, the output of (a) is a set of initial clusters which are input to (b) for further improvement by an iterative scheme. Applications of the technique using an IBM-7094 computer on multispectral data sets over Purdue's Flight Line C-1 and the Yellowstone National Park test site have been accomplished. Comparisons between the classification maps by the unsupervised technique and the supervised maximum liklihood technique indicate that the classification accuracies are in agreement. Author

N72-27205*# Illinois Univ., Urbana. Biological Computer Lab.
ASYNCHRONOUS SAMPLING OF SPEECH WITH SOME VOCODER EXPERIMENTAL RESULTS Final Report
M. L. Babcock Jun. 1972 35 p ref
(Grant NGR-14-005-111)
(NASA-CR-127256; NASA-6; UILU-ENG-72-2542) Avail: NTIS HC $3.75 CSCL 09D

The method of asynchronously sampling speech is based upon the derivatives of the acoustical speech signal. The following results are apparent from experiments to date: (1) It is possible to represent speech by a string of pulses of uniform amplitude, where the only information contained in the string is the spacing of the pulses in time; (2) the string of pulses may be produced in a simple analog manner; (3) the first derivative of the original speech waveform is the most important for the encoding process; (4) the resulting pulse train can be utilized to control an acoustical signal production system to regenerate the intelligence of the original speech. Author

N72-27206*# Maryland Univ., College Park.
FGRAAL: FORTRAN EXTENDED GRAPH ALGORITHMIC LANGUAGE
V. R. Basili, C. K. Mesztenyi, and W. C. Rheinboldt Mar. 1972 51 p refs
(Grant NGL-21-002-008; Contract N00014-67-A-0239-0021)
(NASA-CR-127263; TR-179) Avail: NTIS HC $4.75 CSCL 09B

The FORTRAN version FGRAAL of the graph algorithmic language GRAAL as it has been implemented for the Univac

1108 is described. FBRAAL is an extension of FORTRAN 5 and is intended for describing and implementing graph algorithms of the type primarily arising in applications. The formal description contained in this report represents a supplement to the FORTRAN 5 manual for the Univac 1108 (UP-4060), that is, only the new features of the language are described. Several typical graph algorithms, written in FGRAAL, are included to illustrate various features of the language and to show its applicability. Author

N72-27207*# Scripta Technica, Inc., Washington, D.C.
CODING AN INFORMATION SOURCE THAT IS CONTINUOUS IN AMPLITUDE BUT DISCRETE IN TIME
B. S. Tsybakov Washington NASA Dec. 1971 7 p ref Transl. into ENGLISH from Chetvertyy Simp. po Probl. Izbytochnosti v Inform. Sistemakh (Leningrad), v. 1, 1970 p 641-650
(Contract NASw-2036)
(NASA-TT-F-13896) Avail: NTIS HC $3.00 CSCL 09B

A simple method is proposed for coding of communications that are continuous in time. The method lowers the number of data for a given criterion of quality of transmission. The number of blocks in the code necessary for coding is calculated. As an example, the case of Gaussian communication with a quadratic criterion of quality is considered. Author

N72-27208*# Wisconsin Univ., Madison. Computer Science Dept.
LAYERED RECOGNITION NETWORKS THAT PREPROCESS, CLASSIFY, AND DESCRIBE
Leonard Uhr Dec. 1971 40 p refs
(Grants NGR-50-002-160; NSF GJ-583; MH-12266)
(NASA-CR-127266; WIS-CS-71-132) Avail: NTIS HC $4.00 CSCL 09B

A brief overview is presented of six types of pattern recognition programs that: (1) preprocess, then characterize; (2) preprocess and characterize together; (3) preprocess and characterize into a recognition cone; (4) describe as well as name; (5) compose interrelated descriptions; and (6) converse. A computer program (of types 3 through 6) is presented that transforms and characterizes the input scene through the successive layers of a recognition cone, and then engages in a stylized conversation to describe the scene. Author

N72-27209# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
A SIMPLE CORRECTION PROCEDURE FOR QUANTITATIVE ELECTRON PROBE MICROANALYSIS
Kurt F. J. Heinrich, Robert L. Myklebust, Harvey Yakowitz, and Stanley D. Rasberry May 1972 50 p refs Supersedes NBS-TN-521
(NBS-TN-719; NBS-TN-521) Avail: SOD $0.55 as C 13.46:719

A calculation technique for data reduction in quantitative electron probe microanalysis is described. This technique is embodied in a computer program written in FORTRAN 4 for batch processing. Six chemical elements may be determined simultaneously without redimensioning the program. The relative X-ray intensity data are corrected for atomic number, absorption and secondary fluorescence due to characteristic lines. Options for calculating the mass fraction of one chemical element by difference or by stoichiometry are available in the program. Author

N72-27210# Joint Publications Research Service, Arlington, Va.
RECOGNITION OF SPOKEN SIGNALS
G. I. Tsemel 28 Jun. 1972 149 p refs Transl. into ENGLISH from Opoznavaniye Rechevykh Signalov (Moscow), 1971
(JPRS-56370) Avail: NTIS HC $4.50

Research on computer recognition of speech on the basis of segments and smaller sections of sounds of limited sets of words of various languages is described. Extensive background material is presented and discussed. Author

N72-27211*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPLICATION OF AN ONBOARD PROCESSOR TO THE OAO C SPACECRAFT
W. N. Stewart, R. Hartenstein, and C. Trevathan Jun. 1972 121 p
(NASA-TM-X-65937; X-715-72-226) Avail: NTIS HC $8.25 CSCL 09B

The design of a stored program computer for spacecraft use and its application on the fourth Orbiting Astronomical Observatory (OAO) is reported. The computer is a medium scale, parallel machine with a memory capacity of 16384 words of 18 bits each. It possesses a comprehensive instruction repertoire and operates on 45 W of power (including the dc-to-dc converter). The machine operates at a 500-kHz rate and executes an add instruction in 10 microseconds. Its primary functions on OAO C will be auxiliary command storage, spacecraft monitoring and malfunction reporting, data compression and status summary, and possible performance of emergency corrective action for certain anomalous situations. Author

N72-27212# RAND Corp., Santa Monica, Calif.
THE ULTIMATE COMPUTER
Willis H. Ware Apr. 1972 24 p refs Submitted for publication
(P-4825) Avail: NTIS HC $3.25

The feasibility of designing an ultimate computer is discussed. Design costs, physical principles, improved mathematical approaches, and more efficient program implementation are considered. E.H.W.

N72-27213# RAND Corp., Santa Monica, Calif.
VIRTUAL MEASURES FOR COMPUTER SIMULATION EXPERIMENTS
Grace Carter and Edward Ignall Apr. 1972 23 p refs
(P-4817) Avail: NTIS HC $3.25

A virtual measure approach to yield an estimator for computer simulation is described that reduces random variables in inventory sampling techniques. Virtual measures are considered quantities that depend on but do not alter system image at different points in simulated time. G.G.

N72-27214# RAND Corp., Santa Monica, Calif.
INTERACTIVE COMPUTER SIMULATION
E. C. Deland and G. A. Bekey (Univ. of Southern Calif.) Mar. 1972 12 p refs
(Grant GM-15896)
(P-4791) Avail: NTIS HC $3.00

Desirable features and specifications of a computer system designed for simulation purposes focus on synthesis and study of real multiparametered mathematical models. The interconnection of general purpose analog- and digital-computers provides dynamic system simulation techniques and requires the development of specialized modeling languages. Simulation systems also find application in monitoring and control of laboratory experiments with real time data processing. G.G.

N72-27215*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
DATA STORAGE, IMAGE TUBE TYPE Patent Application
Phillip C. Lipoma Filed 28 Jun. 1972 12 p
(Contract NAS9-10950)
(NASA-Case-MSC-14053-1; US-Patent-Appl-SN-266899) Avail: NTIS HC $3.00 CSCL 09B

A data storage system is reported in which a conventional high quality, low cost television vidicon tube is employed as the data storage medium for an electrical input, electrical output signal system. NASA

N72-27216# Maryland Univ., College Park.
WEB AUTOMATA
David L. Milgram Apr. 1972 29 p refs

(Grant NSF GJ-32258X)
(TR-72-182) Avail: NTIS HC $3.50

Automata whose tapes are undirected labeled graphs are defined and shown to have the power of Turing machines. Various restrictions applied to the edge label and node label sets give rise to classes of restricted web automata whose hierarchical relationships are derived. In particular, it is shown that various types of web automata which utilize edge labels exclusively can simulate their node-labeling counterparts. The relationship of web automata to web grammars is investigated and equivalences are proved. Author

N72-27217# National Bureau of Standards, Washington, D.C. Information Processing Technology Div.
A COMPUTER TERMINAL NETWORK FOR TRANSPARENT STIMULATION OF THE USER OF AN ON-LINE RETRIEVAL SYSTEM
Siegfried Treu Jul. 1972 39 p refs
(NBS-TN-732) Avail: SOD $0.45 as C13.46:732

A computer terminal network to enable transparent stimulation of the user of an on-line retrieval system was designed, implemented, and pilot tested. Its basic purpose is to provide a suitable and effective framework and methodology for experimental identification/validation of those human characteristics which should be recognized/reinforced in man-computer interface design. The rationale behind the transparent stimulation approach is presented and the methodology employed for such real-time, unobtrusive scanning and manipulation of the man-computer dialogue is described. A general overview of the hardware and software features of the implemented stimulation network is included. Author

N72-27218*# Radiation, Inc., Melbourne, Fla. Systems Div.
HANDBOOK OF OPERATION AND MAINTENANCE INSTRUCTIONS FOR MODEL 5208A BIT SYNCHRONIZER UNIT
[1972] 76 p
(Contract NAS9-10441)
(NASA-CR-115645; Rept-86185) Avail: NTIS HC $6.00 CSCL 09B

Electrical/mechanical characteristics, operation, theory of operation, parts list, and electrical diagrams for the model 5208A bit synchronizer unit are provided. The unit is capable of performing the functions of bit synchronization and signal conditioning on demodulated wave trains containing amplitude, frequency, and phase distortions, as well as additive noise. Operating frequencies in the 1 to 27 MHz bit rate range are accommodated through the use of discrete frequency plug-in subunits. The unit provides 0 and 180 degree clocks and either a single signal hard decision, or a three bit quantized soft decision data output. Author

N72-27219*# Radiation, Inc., Melbourne, Fla. Systems Div.
DATA COMPRESSION/ERROR CORRECTION DIGITAL TEST SYSTEM. APPENDIX 1: OPERATION Final Report
Jan. 1972 39 p
(Contract NAS9-10441)
(NASA-CR-115643; Rept-86185-D) Avail: NTIS HC $4.00 CSCL 09B

The DC/EC operating instructions are provided for anticipated operating conditions. The instructions are supported by illustrations and tables for the controls and indication of radiation-built equipment. The transmitter control panel provides a functional representation of the system configuration. Inputs and outputs of functional units are brought to jacks on the panel for interconnection and monitoring, and to allow independent use of subsystems of the transmitter. Author

N72-27220*# Genoa Univ. (Italy).
HYBRID COMPUTERS AND SIMULATION LANGUAGES IN THE STUDY OF DYNAMICS OF CONTINUOUS SYSTEMS [CALCOLATORI IBRIDI E LINGUAGGI DI SIMULAZIONE NELLO STUDIO DELLA DINAMICA DEI SISTEMI CONTINUI]
G. M. Acaccia and A. L. Lucifredi Oct. 1970 12 p refs In ITALIAN Submitted for publication Sponsored jointly by ESRO and NASA
(NASA-CR-127252; IIR-70-AL-145) Avail: NTIS HC $3.00

A comparison is presented of the use of hybrid computers and simulation languages as a means of studying the behavior of dynamic systems. Both procedures are defined and their advantages and disadvantages at the present state of the art are discussed. Some comparison and evaluation criteria are presented. ESRO

N72-27221# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
LECTURES ON PLOTTING TECHNIQUES [VORLESUNGEN UEBER GRAPHENTECHNIK]
Uwe Klemm Nov. 1970 179 p refs In GERMAN
(Rept-127) Avail: NTIS HC $11.00

Several graph theoretical algorithms suitable to computer processing are discussed. Examples are given of graph input forms and representations. Interrelations in graphs and noncyclic graphs are mentioned. The neuron model is treated as an example. Algorithms are given for pathfinding. The theory of disjunctive impulse propagation is treated, with special attention to pyramids. The theory of growing structure is presented. ESRO

N72-27222# Naval Avionics Facility, Indianapolis, Ind.
DIGITAL-TO-ANALOG AND ANALOG-TO-DIGITAL CONVERTER MODULES FOR THE STANDARD HARDWARE PROGRAM
Franklin H. Fish 1 Feb. 1972 105 p
(AD-739248; NAFI-TR-1771) Avail: NTIS CSCL 09/5

The report describes the design and development of Digital-to-Analog (D/A) and Analog-to-Digital (A/D) converters for general use in the Standard Hardware Program. Electrical specifications, technical circuit descriptions, typical applications, and mechanical design details are given for each module type. The modules discussed are key coded DBA (A/D Converter Logic Module), DBB (8 Bit D/A Module), DBC (12 Bit D/A, Binary Code Module), DBD(D/A, 3 decade, BCD Code Module). Author (GRA)

N72-27223# Army Missile Command, Redstone Arsenal, Ala. Guidance and Control Directorate.
STATISTICAL ANALYSIS TECHNIQUES FOR ERROR PROPAGATION IN LARGE-SCALE MISSILE SYSTEMS
James R. Rowland and Willard M. Holmes 20 Aug. 1971 78 p refs
(DA Proj. 1X2-63302-D-212)
(AD-739513; RG-TR-71-19) Avail: NTIS CSCL 09/2

The statistical covariance technique is proposed as a computer analysis tool for missile systems error propagation studies. It is shown that on representative examples the statistical covariance technique performs better, based on speed and accuracy, than the traditional Monte Carlo approach of averaging a large number of random simulation runs. Although exact only for linear, time-varying systems, the covariance technique gives attractive approximate results for wide range of nonlinear missile systems. The extension to nonlinear systems utilizes incremental equations about the noise-free solution. Except in the extreme cases of very harsh nonlinearities and high input noise levels, the statistical covariance technique has been shown to yield, for the systems considered, results comparable to 1000 Monte Carlo runs. Author (GRA)

N72-27224# Texas A&M Univ., College Station. Dept. of Industrial Engineering.
SELF-REPAIRING COMPUTERS
James A. Hess May 1971 131 p refs Sponsored by Army
(AD-739417) Avail: NTIS CSCL 09/2

The paper examines various methods of self-repair system design and a low component density fault detection method is described. A computer program utilizing the SPIF method is used to perform the design of monitoring circuitry for several example problems. A self-repairing computer using SPIF monitoring is described to demonstrate the advantages of this method.
Author (GRA)

N72-27225# California Univ., Los Angeles. Dept. of Computer Science.
COMPUTER NETWORK RESEARCH Semiannual Technical Report, 1 Jul. - 31 Dec. 1971
Leonard Kleinrock, Gerald Estrin, Michel Melkanoff, and Richard R. Muntz 31 Dec. 1971 157 p refs
(Contract DAHC15-69-C-0285; ARPA Order 1380)
(AD-739705) Avail: NTIS CSCL 09/2

The semiannual technical report covers the period 1 July 1971 through 31 December 1971. Activities are focused on modeling, analysis, measurements and systems software. In Section 2 some of the results from modeling and measurement of time-shared computer systems are discussed; this section also presents results from the network modeling and simulation activities. In Section 3 the network measurement activity, including proposed specifications for additional required tools, is described. In Section 4 some of the network and systems software development progress are described. GRA

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N72-27226* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INDUCTANCE DEVICE WITH VACUUM INSULATION Patent
Channing C. Conger, inventor (to NASA) Issued 7 Mar. 1972 3 p Filed 28 Jan. 1971 Supersedes N71-31125 (09 - 18, p 2898)
(NASA-Case-LEW-10330-1; US-Patent-3,648,209; US-Patent-Appl-SN-110402; US-Patent-Class-336-220; US-Patent-Class-336-60; US-Patent-Class-336-198) Avail: US Patent Office CSCL 09A

Electromagnetic components for use in space are made with materials of low gas entrapping capability. The electromagnetic components include electrical winding. The windings are loosely wound to provide adequate vent paths to the surface of the windings. The vacuum of space is utilized for insulation.
Official Gazette of the U.S. Patent Office

N72-27227* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
PRESSURIZED LIGHTING SYSTEM Patent
Graydon A. Phlieger, Jr., inventor (to NASA) Issued 27 Jun. 1972 6 p Filed 12 Feb. 1971 Supersedes N72-21250 (10 - 12, p 1587)
(NASA-Case-KSC-10644; US-Patent-3,673,424; US-Patent-Appl-SN-114849; US-Patent-Class-307-118; US-Patent-Class-307-92; US-Patent-Class-340-240) Avail: US Patent Office CSCL 09E

A safety lighting system for a chain of lamps, each of which is housed within a hermetically sealed translucent tubular housing member is reported. A control box is provided for supplying electrical power to the lamps in the lighting assemblies. A pressurized source of inert gas is fed through the control box at a predetermined pressure and through each of the sealed translucent tubular housing members. A pressure sensitive switch is provided in the control box for disconnecting the electrical power to the lamps when the pressure of the inert gas within any of the translucent tubular housing members drops below a predetermined level.
Official Gazette of the U.S. Patent Office

N72-27228* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
UNINSULATED IN-CORE THERMIONIC DIODE Patent
Jerry P. Davis, inventor (to NASA) Issued 27 Jun. 1972 5 p Filed 15 Oct. 1968 Sponsored by NASA
(NASA-Case-NPO-10542; US-Patent-3,673,440; US-Patent-Appl-SN-767741; US-Patent-Class-310-4) Avail: US Patent Office CSCL 09E

A thermionic energy converter is provided containing diodes externally heated by a reactor and externally connected in series parallel arrangement. Each diode assembly comprising a tubular anode within a tubular cathode is located in the core of a nuclear reactor. Ceramic spacers and seals are located at the ends of the diode tubes outside the reactor core. A conductive coolant system is connected directly to the ends of the tubular anodes of a first group of diodes. A conductive bus connects the cathodes of the first group of diodes to complete a parallel arrangement. A second group of diodes in a similar parallel arrangement is connected in series with the first by a direct electrical connection from the bus of one group to the coolant system of the other. Official Gazette of the U. S. Patent Office

N72-27229*# Scientific Translation Service, Santa Barbara, Calif.
THE 10 A SWITCHING TRANSISTOR
A. Bachmeier, S. Bertsch, R. Flockan, G. Jakob, and H. Schiller Washington NASA Jul. 1972 28 p refs Transl. into ENGLISH from "Projekt Nachrichttensatellit. Teil 2: Halbleiter-Bauelemente und Frequenzumsetzer" Rept. BMBW-FB-W-71-33, Bundesmin. fuer Bildung und Wissl., Jul. 1971 p 8-30
(Contract NASw-2035)
(NASA-TT-F-14338; BMBW-FB-W-71-33) Avail: NTIS HC $3.50 CSCL 09A

The development of a silicon-controlled rectifier (SCR), and subsequently a 10 ampere switching transistor is reported. An electronically controlled switch was used for the power supply to the traveling wave tube and the main controller of the telecommunication part of a communications satellite. A choice had to be made between a turn-off SCR and a correspondingly designed switching transistor. The choice finally was for a specially adapted transistor because of its low saturation current, and a turn-off time shorter than 1 microsecond. Author

N72-27230*# Duke Univ., Durham, N.C. School of Engineering.
REGULATED dc TO dc CONVERTER FOR VOLTAGE STEP-UP OR STEP-DOWN WITH INPUT-OUTPUT ISOLATION Patent Application
Sam Y. M. Feng and Thomas G. Wilson, inventors (to NASA) Filed 18 Apr. 1972 27 p
(Grant NGL-34-001-001)
(NASA-Case-HQN-10792-1; NASA-Case-HQN-10793-1; US-Patent-Appl-SN-245063) Avail: NTIS HC $3.50 CSCL 09E

A closed loop regulated dc-to-dc converter employing an unregulated two winding inductive energy storage converter is described that uses a magnetically coupled multivibrator acting as a duty cycle generator to drive the converter. The multivibrator is comprised of two transistor switches and a saturable transformer. The output of the converter is compared with a reference in a comparator which transmits a binary zero until the output exceeds the reference. When the output exceeds the reference, the binary output of the comparator drives transistor switches which control the multivibrator to turn it off. NASA

N72-27231*# Sperry Rand Corp., Gainesville, Fla. Sperry Electronics Tube Div.
MASS SPECTROMETER TUBE CONSTRUCTION Final Report, Sep. 1971 - Apr. 1972

J. H. Bottcher May 1972 15 p
(Contract NAS5-11487)
(NASA-CR-122433) Avail: NTIS CSCL 09E

Work performed for the construction and delivery of four RF mass spectrometer tubes is reported. Author

N72-27232*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MEANS FOR ADJUSTING INPUT SIGNAL BIAS Patent Application
Howell D. Garner and Richard F. Hellbaum, inventors (to NASA) Filed 15 May 1972 21 p
(NASA-Case-LAR-10868-1; US-Patent-Appl-SN-253249) Avail: NTIS HC $3.25 CSCL 09E

A flueric beam-deflection amplifier and a method of controlling the same is shown wherein either a single or a series of cascaded fluid amplifier units are provided, each one of which may include the usual power nozzle, control nozzles, outlet passages and vent passages. All vent passages of each fluid amplifier unit lead to an enclosed outlet chamber which is connected to the ambient environment or to a return manifold through a variably restricted passage. To control the fluid amplifier unit, power and control stream pressures are first established, after which the restricted passage is reduced to regulate the input bias, the gain and the input impedance of the fluid amplifier unit. As examples, the vent outlet chamber may be a container completely enclosing the fluid amplifier unit or an enclosed chamber formed integrally within the fluid amplifier unit and communicating with the vent passages. NASA

N72-27233*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
BIO-ISOLATED dc OPERATIONAL AMPLIFIER Patent Application
Robert D. Lee, inventor (to NASA) Filed 30 Jun. 1972 9 p
(NASA-Case-ARC-10596-1; US-Patent-Appl-SN-267862) Avail: NTIS HC $3.00 CSCL 09E

A bio-isolated dc operational amplifier is reported for making bioelectrical measurements of a patient while providing isolation of the patient from electrical shocks. The circuit is comprised of a first operational amplifier coupled to the patient; its output is coupled in a forward loop through a first optic coupler to a second operational amplifier. The output of the second operational amplifier is coupled via a feedback circuit including a second optical coupler to the input of the first operational amplifier. NASA

N72-27234*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
LIGHTNING TRACKING SYSTEM Patent Application
R. J. Wojtasinski and James H. Jones, inventors (to NASA) Filed 28 Jan. 1972 15 p
(NASA-Case-KSC-10729-1; US-Patent-Appl-SN-221714) Avail: NTIS HC $3.00 CSCL 09E

A system for locating lightning strikes by developing the coordinates of a pair of lines, each of which is produced at a reference sensing station is reported. At each station there are a pair of directional antennas which produce analog signals responsive to a lightning stroke. These analog signals are fed to a pair of integrators which integrate the signals for a predetermined period of time so as to produce the X and y co-ordinate of a particular line. The analog signals are also fed through a square rooter, a Schmitt trigger circuit, and flip-flops to produce pulses for starting and stopping the integrators. The system at the remote station is similar to that at the central station and is tied to the circuitry at the central station through logic circuits to minimize the chance of error from spurious signals. Computers, printers, and plotters are utilized to plot the exact location of the lightning stroke. NASA

N72-27235*# Genoa Univ. (Italy).
CAPACITIVE TRANSDUCERS [I TRASDUTTORI CAPACITIVI]
Aleramo L. Lucifredi Sep. 1970 24 p refs In ITALIAN Submitted for publication Sponsored jointly by ESRO and NASA
(NASA-CR-127251; IIR-70-AL-146) Avail: NTIS HC $3.25 CSCL 09A

The theory, applications, and possible structural designs of capacitive transducers are presented. Emphasis is placed on the circuits used in connection with the sensors, such as AM, FM, resonant circuits, mode circuits, direct current circuits, and special circuits. Some criteria for selection of a design or the purchase of a commercial device are given. ESRO

N72-27236# Radio Corp. of America, Moorestown, N.J. Missile and Surface Radar Div.
INITIAL TEST SEQUENCE, SFD-222AH CROSSED FIELD AMPLIFIER
14 Mar. 1972 5 p
(Contract N00014-70-C-0013)
(AD-738458) Avail: NTIS CSCL 09/1

The report discusses results from life tests made on the crossed field amplifier. Author

N72-27237# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
REMOVING THE DEFECT IN A DIFFERENTIAL BUS PROTECTION CIRCUIT
V. M. Meyer 22 Nov. 1971 10 p Transl. into ENGLISH from Elektr. Stantsii (Moscow), no. 2, 1969 p 85
(AD-739213; FTD-MT-24-104-71) Avail: NTIS CSCL 09/5

Circuits are designed to test buses in order that there be no short-circuits in the buses. This is accomplished by using oil and air switches and by relays. Author (GRA)

N72-27238# Mitre Corp., McLean, Va.
THE SINGLE-SIDED LIM WITH SATURATED BACK IRON Final Report
John K. Dukowicz Jan. 1972 62 p refs
(Contract DOT-FR-7-35248)
(PB-207327; MTR-6094; FRA-RT-72-28) Avail: NTIS HC $3.00 CSCL 09C

For reasons of economy, the single sided linear induction motor should be designed to operate with saturated reaction rail back iron. The effects of back iron saturation on the performance of the motor are discussed, and a technique for determining the minimum thickness of iron required is formulated. As a specific example, the TACRV motor is analyzed in detail. It is found that a laminated iron backing of only 3/4 inch thickness is required. Author (GRA)

N72-27239# Texas A&M Univ., College Station. Dept. of Industrial Engineering.
MAINTENANCE TIME COMPARISON OF TRANSISTORS VERSUS TUBES M.S. Thesis
James C. Ault May 1971 35 p refs
(AD-739476) Avail: NTIS CSCL 09/1

The paper contains a maintenance time comparison between tubes and transistors. The two parameters used for the comparison are the mean time to repair and the mean time between failures. Distributions for active repair times are calculated for each case and a life cycle maintenance cost is compared for the two cases. Author (GRA)

N72-27240# Turku Univ. (Finland).
AN ELECTRON GUN FOR AUGER AND ULTRASOFT X-RAY APPARATUS
V. M. Pessa Helsinki Finn. Acad. of Tech. Sci. 1971 17 p refs Supported by NRC for Tech. Sci. (Finland)
(PB-207208; APS-Ph-84) Avail: NTIS HC $3.00; Acta Polytechnica Scandinavica Publishing Office, Box 5073, Stockholm 5, Sweden, HC Sw. Kr. 10.00 CSCL 09A

A small size electron gun with four electrodes was constructed especially for Auger and ultrasoft X-ray instruments. The gun

produces a roughly parallel electron beam with high intensity at constant potentials between 0.5 and 6 keV. The beam has in this energy range an intense core of about 1 mm in diameter. An optical bench is used as a framework in the construction of the gun. All critical lens parameters as well as constructional details are given. The potential of the third electrode giving the maximum beam current is found to depend linearly on the beam energy. The two other electrodes are maintained at constant voltages. Author (GRA)

N72-27241# Research Inst. of National Defence, Stockholm (Sweden).
DESIGN OF MULTISTAGE TRANSISTOR AMPLIFIERS USING SCATTERING PARAMETERS
Peter U. Tamm Feb. 1972 16 p refs
(PB-207377) Avail: NTIS; Editorial Office: FOAP, 104 50 Stockholm 80, (Sweden). PC Sw. Kr. 41 CSCL 09E

The cascade coupling of microwave bipolar transistors was used to form a broadband amplifier. An original method of synthetizing an amplifier with an arbitrary number of stages is presented. Conditions for using a unilateral transistor model are also discussed, and a brief treatment of gain matching vs. noise matching indicates future possibilities for simultaneous high amplification and low noise factor in a transistor amplifier.
Author (GRA)

N72-27242# Harry Diamond Labs., Washington, D.C.
COMPARISON OF POTENTIAL STEP AND TRIANGULAR VOLTAGE SWEEP METHODS OF DOUBLE LAYER CAPACITANCE MEASUREMENTS. 2: POROUS SILVER ELECTRODES
Robert A. Myers, William F. Cowherd, and Werner H. Steuernagel Dec. 1971 49 p refs
(DA Proj. 1T0-61102-A-34-A)
(AD-739482; HDL-TR-1578) Avail: NTIS CSCL 09/1

An important parameter affecting the performance of electrochemical cells is the wetted surface area of the electrodes. Several methods have been developed for the determination of real, or total surface area. The report describes the double layer capacitance method which involved measurements on porous silver electrodes using both the potential step and triangular voltage sweep techniques. The effects of operating potential, temperature, electrolyte concentration, and electrode thickness on double layer capacitance were investigated. The two methods yielded similar results in the region of minimum capacitance. Both volumetric and gravimetric techniques were used to determine the actual surface areas of the silver electrodes. Author (GRA)

N72-27243# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
EXPERIMENTS ON THE JOSEPHSON JUNCTION AMPLIFIER
A. VanderZiel and Choe H. M. Mar. 1972 15 p refs
(Contract N00014-67-A-0113-0010)
(AD-739383) Avail: NTIS CSCL 09/5

Experiments are reported on the Josephson junction amplifier. The authors obtained a minimum signal level of 3.5 x 10 to the minus 11 power volt/(Hz) to the 1/2 power for a bias resistance r sub s = 7.2 mohms. Various modes of oscillation of the junction and of the f.m. noise associated with them are discussed. Author (GRA)

N72-27244# Teledyne MEC, Palo Alto, Calif.
THE 3kW SATCOM TRANSMITTER TRAVELING-WAVE TUBE Final Report
Mar. 1972 113 p
(Contract DAAB07-70-C-0154)
(AD-739542) Avail: NTIS CSCL 09/1

Development of an advanced 3 kW CW transmitter traveling-wave tube designed for military satellite communications is reported in detail. Gain ripple limitation of plus or minus 0.25 dB/40 MHz, the most challenging parameter, was approximately four times as severe a restriction as that imposed on similar tubes already in use in Comsat stations. The bandwidth of 7.9 to 8.4 at 3 kW called for use of a coupled-cavity TWT. An efficiency requirement of 30 percent required large amounts of gain in the output section of the tube and made match factors more critical and more difficult to achieve than those usually encountered. The necessary fine grain gain characteristics necessitated the use of an excellent gain equalizer in an unusual application. Author (GRA)

N72-27245# Naval Weapons Lab., Dahlgren, Va.
ANALYSIS OF THE ROLLING MOTION OF FINNED MISSILES AT LARGE ANGLES OF ATTACK
Charles J. Cohen and Thomas A. Clare Feb. 1972 20 p refs
(AD-739685; NWL-TR-2671) Avail: NTIS CSCL 09/1

A method is presented for analyzing the single degree of freedom, nonlinear rolling motion of finned missiles. A nonlinear least squares fitting procedure is developed which is amenable to extracting the coefficients of linear and nonlinear roll moment terms from the rolling motion of missiles exhibiting roll lock-in, roll break-out, roll speed-up and combinations thereof. These phenomena and the second order differential equation describing them are sufficiently nonlinear to require a special application of the standard, nonlinear least squares procedure for fitting ordinary differential equations to observed data. The equations employed in this "global" nonlinear least squares application and their relation to the roll phenomena in question are presented in this report. Author (GRA)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N72-27246* National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
METHOD AND APPARATUS FOR LIMITING FIELD EMISSION CURRENT Patent
Wayne L. Lees, inventor (to NASA) Issued 20 Jun. 1972 7 p Filed 11 Dec. 1970 Supersedes N72-22205 (10 - 13, p 1717) Continuation-in-part of abandoned US Patent Appl. SN-763744, filed 30 Sep. 1968
(NASA-Case-ERC-10015-2; US-Patent-3,671,798; US-Patent-Appl-SN-97343; US-Patent-Class-313-336; US-Patent-Class-313-351; US-Patent-Class-313-309; US-Patent-Class-315-36; US-Patent-Appl-SN-763744) Avail: US Patent Office CSCL 09C

Self-protected electrodes which inherently limit field emitted currents to a safe value and also stabilize such currents are disclosed. The electrodes are characterized by a plurality of columnar conductors connected at one end to a common potential source. The electrodes are insulated from one another along their lengths whereby the effective or exposed surfaces thereof are subdivided into a mosaic of conducting patches which are insulated from one another.
Official Gazette of the U.S. Patent Office

N72-27247 National Lending Library for Science and Technology, Boston Spa (England).
THE DIMENSIONING OF ANTI-CORONA ELECTRODES FOR A HIGH VOLTAGE RESEARCH LABORATORY
M. Simon et al 11 May 1972 19 p Transl. into ENGLISH from Bull. Dir. Etud. Rech., Ser. B. (France), no. 2, 1970 p 3954
(NLL-CE-Trans-5794-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

In a high voltage circuit no unexpected flashover must take place along the conductors, and no disturbance must be

transferred to the measurement circuit. The use of these two criteria to get the dimensions of anti-corona electrodes is often not accurate. Reduced scale experiments with high voltage tests and with an electrolytic tank were carried out in order to check some of the given assumptions and led to useful coefficients for the dimensioning of double toroids. Results will be confirmed at high voltages by further experiments. Author

N72-27248 *National Lending Library for Science and Technology, Boston Spa (England).*

NEW GENERAL CONFIGURATION AND NEW SYNTHESIS PROCEDURE FOR ALL PASS NETWORKS OF THE RC TYPE

A. Liberatore and E. Bahrabadi 7 Jun. 1972 15 p refs Transl. into ENGLISH from Alta Frequenza (Milano), v. 40, no. 3, Mar. 1971 p 219-224

(NLL-Trans-2850-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A new circuit configuration is described, in which use is made of a differential operational amplifier, with two parts of the RC type mounted on a Wien bridge for the realization of all-pass networks. It is then shown that this configuration is more general since it includes all the all-pass RC networks which have appeared up to now in the technical literature, and which have been realized by differential operational amplifiers with a very large gain. A new synthesis procedure for all-pass transfer functions is included. Author

N72-27249*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

THIRD ORDER PHASE LOCKED LOOPS Patent Application

Robert B. Crow and Robert C. Tausworthe, inventors (to NASA) Filed 6 Apr. 1972 37 p

(Contract NAS7-100)

(NASA-Case-NPO-11941-1; US-Patent-Appl-SN-241614) Avail: NTIS HC $4.00 CSCL 09C

Filters for third order phase-locked loops used in receivers to acquire and track carrier signals, particularly signals subject to high Doppler rate changes in frequency, are provided by employing a loop filter with an open loop transfer function and, for given set of loop constants, setting the damping factor equal to unity. NASA

N72-27250*# Sperry Rand Research Center, Sudbury, Mass.

RESEARCH ON VARIABLE THRESHOLD TRANSISTOR STORAGE SYSTEMS Final Report

H. A. R. Wegener, R. E. Oleksiak, and E. T. Lewis Apr. 1970 53 p

(Contract NAS12-686)

(NASA-CR-127276; SRRC-CR-70-9) Avail: NTIS HC $4.75 CSCL 09C

A fully integrated, electrically alterable, nonvolatile, nondestructive readout control memory was developed, using as storage elements metal-nitride-silicon variable threshold transistors. An optimum approach to such a memory was developed in which a three dimensional selection technique was used, both for read and write operations. Electrical isolation of writing and memory circuits was obtained by means of separate memory and write circuit chips. This method provided protection from voltage breakdowns, increased circuit flexibility, and greater ease of testing of interim and final circuit elements. Author

N72-27251*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

DIGITAL CANOPUS TRACKER DIGITAL ELECTRONICS

W. E. Crawford 1 Jul. 1972 15 p

(Contract NAS7-100)

(NASA-CR-127418; JPL-TR-32-1559) Avail: NTIS HC $3.00 CSCL 09C

Circuitry has been developed for digital control of the Canopus tracker. A feasibility and demonstration breadboard has been constructed using microelectronic integrated circuits. The breadboard contains the digital circuits necessary for closed-digital logic necessary for star acquisition, particle rejection, programmable gate selection, cone angle selection, and routing of the digital roll error signal. Author

N72-27252*# Colorado Univ., Boulder. Dept. of Electrical Engineering.

SYNTHESIS PROCEDURE FOR LINEAR TIME-VARYING FEEDBACK SYSTEMS WITH LARGE PARAMETER IGNORANCE

Thomas Edwin McDonald, Jr. 1 Apr. 1972 312 p refs Sponsored in part by NSF

(Grant NGR-06-003-083)

(NASA-CR-116777) Avail: NTIS HC $17.75 CSCL 09C

The development of synthesis procedures for linear time-varying feedback systems is considered. It is assumed that the plant can be described by linear differential equations with time-varying coefficients; however, ignorance is associated with the plant in that only the range of the time-variations are known instead of exact functional relationships. As a result of this plant ignorance the use of time-varying compensation is ineffective so that only time-invariant compensation is employed. In addition, there is a noise source at the plant output which feeds noise through the feedback elements to the plant input. Because of this noise source the gain of the feedback elements must be as small as possible. No attempt is made to develop a stability criterion for time-varying systems in this work. Author

N72-27253*# Colorado Univ., Boulder. Dept. of Electrical Engineering.

SYNTHESIS OF FEEDBACK SYSTEMS WITH LARGE PLANT IGNORANCE FOR PRESCRIBED TIME DOMAIN TOLERANCES

Isaac M. Horowitz and Marcel Sidi 1 Jul. 1971 93 p refs

(Grant NGR-06-003-083)

(NASA-CR-116779) Avail: NTIS HC $6.75 CSCL 13H

There is given a minimum-phase plant transfer function, with prescribed bounds on its parameter values. The plant is imbedded in a two-degree-of freedom feedback system, which is to be designed such that the system time response to a deterministic input lies within specified boundaries. Subject to the above, the design should be such as to minimize the effect of sensor noise at the input to the plant. This report presents a design procedure for this purpose, based on frequency response concepts. The time-domain tolerances are translated into equivalent frequency response tolerances. The latter lead to bounds on the loop transmission function in the form of continuous curves on the Nichols chart. The properties of the loop transmission function which satisfy these bounds with minimum effect of sensor noise, are derived. Author

N72-27254# Joint Publications Research Service, Arlington, Va.

MULTITUBE GENERATOR BANK

G. I. Zverev, V. L. Lyulyev, V. B. Mayburov, I. S. Savchenko, and R. I. Yampolskiy 28 Jun. 1972 7 p refs Transl. into ENGLISH from Preprint-6 (Russian), 24 Nov. 1970 p 1-13

(JPRS-56371) Avail: NTIS HC $3.00

Four-phase tube generators for excitation of the circuits shaping the high frequency fields of various configurations used in plasma physics research are described. The generators can operate in two modes: independent excitation and autooscillation. In the autooscillation mode the load is the field-shaping circuit. The total installed power of the generator bank tubes is about 80 megawatts per pulse lasting 1-1.5 milliseconds with a duty cycle frequency of 0.5 to 2 megahertz and a pulse repetition rate of 0.05 to 0.1 hertz. The problem of obtaining high power is solved by adding the powers of groups of generator tubes included in parallel in the load. Author

N72-27255*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

TECHNIQUE FOR EXTENDING THE FREQUENCY RANGE

OF DIGITAL DIVIDERS Patent Application
Walt C. Long and Joan H. Middleton, inventors (to NASA) Filed 30 Mar. 1972 12 p
(NASA-Case-LAR-10730-1; US-Patent-Appl-SN-239573) Avail: NTIS HC $3.00 CSCL 09C

A technique for extending the frequency range of a presettable digital divider is described. The conventional digital divider consists of several counter stages with the count of each stage compared to a preselected number. When the counts for all stages are equal to the preselected numbers, an output pulse is generated and all stages are reset. For high input frequencies, the least significant stage of the divider has to be reset in a very short time. This limits the frequency that can be handled by the conventional digital divider. This invention provides a technique in which the second least significant and higher stages are reset and the least significant stage is permitted to free-run. Hence, the time in which the reset operation can be performed is increased thereby extending the frequency range of the divider.
NASA

N72-27256# RAND Corp., Santa Monica, Calif.
REMOTELY MANNED SYSTEMS: ORIGINS AND CURRENT CAPABILITIES
Terrell E. Greene Feb. 1972 19 p refs
(P-4809) Avail: NTIS HC $3.00

The biological and economic aspects of remotely manned systems, their technological base, and the development of integrated systems are considered. The various parts of the systems are discussed, including sensors, experimenters, displays, manipulators, and computers. A logic diagram is also presented.
J.A.M.

N72-27257# Michigan Univ., Ann Arbor. Electron Physics Lab.
MICROWAVE SOLID-STATE DEVICE AND CIRCUIT STUDIES Quarterly Report, 1 Sep. - Dec. 1971
G. I. Haddad Jan. 1972 64 p refs
(Contract F30602-71-C-0099; AF Proj. 5573)
(AD-739549; RADC-TR-72-17; QR-5) Avail: NTIS CSCL 09/1

This is the fifth quarterly report on subject contract whose objectives are to investigate theoretically and experimentally new solid-state phenomena and techniques having application to microwave generation, amplification and control. Current tasks under this program are the following: High-power Gunn-effect devices; Gunn-effect amplifiers; Modulation properties of Gunn-effect dzvices; Avalanche-diode amplifiers; High-efficiency avalanche diodes; Nonlinear operating characteristics of IMPATT diodes; Solid-state device fabrication; and Instabilities in germanium.
GRA

N72-27258# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ADVANCED ELECTRONIC TECHNOLOGY Quarterly Technical Summary, 1 Nov. 1971 - 31 Jan. 1972
Melvin A. Herlin and Alan L. McWhorter 15 Feb. 1972 22 p refs
(Contract F19628-70-C-0230; AF Proj. 649L)
(AD-739548; ESD-TR-72-34) Avail: NTIS CSCL 09/2

The document contains reports on Integrated circuit processing, Integrated circuit applications, and semiconductor testing and design in digital computers and a section on computer systems. Reports contained in the solid state section include solid state device research, quantum electronics, materials research, physics of solids, and microelectronics. GRA

N72-27259# Cornell Univ., Ithaca, N.Y.
ADVANCED CONCEPTS OF MICROWAVE GENERATION AND CONTROL IN SOLIDS Quarterly Progress Report, 1 Jul. - 30 Sep. 1971
G. C. Dalman, L. F. Eastman, C. A. Lee, and J. Frey Jan. 1972 151 p refs
(Contract F30602-71-C-0110)
(AD-739543; RADC-TR-71-307; QPR-4) Avail: NTIS CSCL 09/1

The report deals with the progress made during the fourth quarterly period of a solid state microwave oscillator and amplifier research and development program. Discussed first is the progress on Gunn effect research. Work on the following specific topics is reviewed: frequency control studies of LSA oscillators; some harmonic properties of an LSA oscillator; LSA circuit studies; control of silicon contamination in GaAs; a varactor tuned Gunn oscillator; and Gunn effect amplifiers. The progress made on a program on avalanche devices is also described. The following specific topics are reviewed: higher average power TRAPATT considerations; GaAs Schottky barrier IMPATT diodes; nonlinearities of IMPATT reflection amplifiers with two input signals; integrated IMPATT and TRAPATT oscillators; and high-frequency high-efficiency avalanche oscillations. Studies of an experimental Pt-n-p and punch-through-injection Ku-band diode are reported. Finally, the progress made on the studies of solid state materials for microwave devices are reported. The topics include: ion implantation and diffusion; vacuum epitaxial growth in silicon; and ionization rates in gallium arsenide.
Author (GRA)

N72-27260# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Materials Directorate.
A PRELIMINARY STUDY OF DISTURBANCE ABSORBING CONTROLLERS FOR SERVOMECHANISM PROBLEMS
C. D. Johnson 10 Dec. 1971 33 p refs
(DA Proj. 1M2-62303-A-214)
(AD-739503; RL-TR-71-15) Avail: NTIS CSCL 12/1

Controllers for servomechanism problems are ordinarily designed under the unrealistic assumption that no external disturbances are acting on the plant. Such controllers may fail to meet performance specifications when the plant is, in fact, subjected to persistently acting external disturbances. In this study, the author's recently developed theory of disturbance absorbing controllers is extended to include a special class of servomechanism controllers. The result is a new variety of servomechanism controller which can maintain high accuracy servo-tracking in the face of a broad class of unknown, unmeasurable, persistently acting external plant disturbances. The extension of these results to cover a more general class of servomechanism problems will be investigated in a future study.
Author (GRA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N72-27261*+ National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
AS-511 FACILITIES AND ENVIRONMENTAL MEASUREMENTS PROGRAM
10 Jan. 1972 117 p
(NASA-TM-X-68517; KSC-GP-958) Avail: NTIS HC $8.00 CSCL 14B

A list is presented of the facilities and environmental measurements to be monitored in support of the Apollo/Saturn vehicle AS-511. The measurement identification number, description, transducer operating range, recorder type and drawings illustrating measurement location are included. The following launch complex 39 facilities will be used on this vehicle: launch complex 39 pad A, and launcher umbilical tower number 3.
Author

N72-27262* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ALTITUDE SIMULATION CHAMBER FOR ROCKET ENGINE TESTING Patent
John W. Davis and Herschel W. Belew, Jr., inventors (to NASA) Issued 20 Jun. 1972 7 p Filed 21 Jun. 1971 Supersedes N71-34242 (09 - 21, p 3407)
(NASA-Case-MFS-20620; US-Patent-3,670,564; US-Patent-Appl-SN-154935; US-Patent-Class-73-117.1; US-Patent-Class-73-432SD) Avail: US Patent Office CSCL 14B

A vacuum chamber is described in which a scale model of the rocket engine base area of a space vehicle is mounted and fired in short duration runs for testing the model under simulated, high-altitude pressure conditions. To dissipate the engine exhaust energy, and particularly the starting shock wave produced when the engine is fired, an energy-absorbing compartment is provided within the vacuum chamber. The cells of the honeycomb panels are opened on the inner side of the panels to present a large, cold and confining surface area to dissipate the energy of the exhaust gas molecules by capturing and freezing the molecules within the honeycomb cells.
Official Gazette of the U.S. Patent Office

N72-27263* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ENVIRONMENTAL IMPACT STATEMENT FOR THE GODDARD SPACE FLIGHT CENTER Final Environmental Impact Statement
17 Dec. 1971 57 p refs
(NASA-TM-X-68549) Avail: NASA Public Document Rooms, $1.00 CSCL 14B

Environmental setting, facilities, research and development activities, and environmental monitoring and control are discussed within the environmental impact survey of the Goddard Space Flight Center in Greenbelt, Maryland. The center's coordination with local, state, and federal agencies is also reviewed. J.A.M.

N72-27264* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ENVIRONMENTAL IMPACT STATEMENT FOR NASA'S MARSHALL SPACE FLIGHT CENTER Draft Environmental Impact Statement.
Feb. 1971 7 p
(NASA-TM-X-68542) Avail: NASA Public Document Rooms, $1.00 CSCL 14B

The environmental impact statement is presented for the George C. Marshall Space Flight Center, Huntsville, Alabama, and the Mississippi Test Facility in Hancock County, Mississippi. The missions, facilities, and R and D activities are described along with the sewage disposal, surface runoff, industrial waste treatment, air pollution, solid waste disposal, and land management. It is concluded that current activities have a minimum impact on the environment. F.O.S.

N72-27265* National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
ENVIRONMENTAL IMPACT STATEMENT CONCERNING ACTIVITIES OF THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AT WALLOPS ISLAND, VIRGINIA Draft Environmental Impact Statement
Feb. 1972 13 p refs
(NASA-TM-X-68547) Avail: NASA Public Document Rooms, $1.00 CSCL 14B

The environmental impact statement for Wallops Station, Virginia, is presented. The NASA R and D activities are described along with the probable environmental impact. The potential sources of adverse environmental effects discussed include: sewage treatment, water supply, solid waste disposal, launch activities, and erosion. It is concluded that other than the use of fuels for heat and motive power and the negligible amount of resources expended in day-to-day activities, there are no known irreversible committment of resources at Wallops Station. F.O.S.

N72-27266* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENVIRONMENTAL IMPACT STATEMENT FOR NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LEWIS RESEARCH CENTER, CLEVELAND, OHIO Final Environmental Impact Statement
Jul. 1971 26 p
(NASA-TM-X-68557; PB-202052-F) Avail: NASA Public Document Rooms, $1.00 CSCL 14B

The probable environmental impact and adverse effects of the Lewis Research Center are assessed. The Cleveland and Plum Brook facilities are briefly described. It is felt that the absence of harmful environmental impact from the Cleveland site is apparent, and the monitoring at the Plum Brook reactor facility shows the effectiveness of effluent controls. The probable adverse effects are considered for air, water, and noise pollution, and radioactive and hazardous waste storage and disposal; it is concluded that all emissions are maintained below Federal, and local standards. There are no appropriate alternatives to the operation of the Center, and no improvement in environmental quality would result from relocation. The relationship between local short-term productivity is briefly discussed. No adverse comment has been received from public agencies or private organizations or individuals. N.E.N.

N72-27267* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ENVIRONMENTAL IMPACT STATEMENT FOR THE JET PROPULSION LABORATORY Final Environmental Impact Statement
Feb. 1972 40 p refs
(NASA-CR-127575; PB-207332-F) Avail: NASA Public Document Rooms, $1.00 CSCL 14B

This statement addresses the Jet Propulsion Laboratory of the California Institute of Technology in institutional terms, describing its mission, facilities, and community setting, and assessing its environmental impact. The statement covers the principal installation at Pasadena, California (Los Angeles County) and specialized auxiliary installations at Edwards Test Station near Mojave, California (Kern County) and Table Mountain near Wrightwood, California (Los Angeles County). The principal environmental impact of the Laboratory has been in its stimulation of urban growth with the related direct and secondary effects. The situation is now one of maturity, and significant further growth in either the Laboratory or community around it is unlikely. Adverse effects in day-to-day operations are limited to the unavoidable consumption of fuel, power, and other resources, and the disposal of waste products. Author

N72-27268* National Aeronautics and Space Administration, Washington, D.C.
ENVIRONMENTAL STATEMENT, REACTOR TESTING, FY 1972 NUCLEAR ROCKET DEVELOPMENT STATION NEVADA Final Environmental Impact Statement
Dec. 1971 87 p refs Prepared in cooperation with AEC
(NASA-TM-X-68555; WASH-1508) Avail: NASA Public Document Rooms, $1.00 CSCL 14B

A program managed by the joint AEC-NASA Space Nuclear Systems Office has been underway since 1955 to realize the potential inherent in nuclear rockets. Testing of materials, fuel elements, and design concepts is essential to progress and nineteen experimental reactors and engines have been ground tested to date at the Nuclear Rocket Development Station in Nevada. In addition, methods of providing various facility equipment to reduce fission product release were explored and resulted in the adoption of effluent gas and liquid waste cleaning systems which are expected to be very effective and result in minimal environmental impact. However, there is expected to be an unavoidable release of small quantities of radioactivity which is not expected to exceed two to four percent of the Federal Radiation Council guidelines; possible biological effects on fish and wildlife are not considered significant; population density or distribution will not be affected; and land utilization will be minimal and reversible and will not preclude the use of the site for other purposes after the termination of the proposed operations. Author

N72-27269 Japan Broadcasting Corp., Tokyo.
NHK KINUTA SHF EXPERIMENTAL STATION
Taiji Saito, Katsuaki Uenakada, Kenji Ohmaru, Keiichi Yasunaga, and Koichi Takano Jan. 1972 11 p
(Rept-150) Copyright. Avail: Issuing Activity

The construction and operation of a superhigh frequency radio transmitting and receiving station are discussed. The installation contains both a sideband amplitude modulation system and a frequency modulation system. Descriptions are presented of the transmitter assembly, antenna and feed system, the signal monitor, and the receiver installation. The effectiveness of the station in transmitting color television programs is reported. Author

N72-27270 National Lending Library for Science and Technology, Boston Spa (England).
WAYS OF CREATING AN AUTOMATIC SYSTEM FOR COLLECTING, STORING, RETRIEVING AND PROCESSING HYDROCHEMICAL INFORMATION FOR STATIONS OF THE USSR HYDROMETEOROLOGICAL SERVICE
N. V. Veselovskij, V. M. Kalincenko, V. L. Pavelko, and M. N. Tarasov [1972] 18 p ref Transl. into ENGLISH from Russian report
(NLL-M-22307-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 Nll photocopy coupons

Automatic methods based on computers are discussed for collecting, storing, retrieving, and acquiring hydrochemical information. The current system for taking samples, analyzing, recording, and filing is described, and the scheme for conversion to automation which was adopted by the Hydrochemical Institute is summarized. The procedures for transferring the accumulated data to computer formats are presented. It is concluded that the automation would raise the reliability and effectiveness of the hydrochemical data. F.O.S.

N72-27271*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPARATUS FOR APPLYING SIMULATED G-FORCES TO AN ARM OF AN AIRCRAFT SIMULATOR PILOT Patent Application
Billy R. Ashworth and John R. Merrill, IV, inventors (to NASA) Filed 9 Jun. 1972 9 p
(NASA-Case-LAR-10550-1; US-Patent-Appl-SN-261183) Avail: NTIS HC $3.00 CSCL 14B

A device to be used with an aircraft simulator to apply positive and negative g-forces to the pilot's arm is described. An arm harness fits around the pilot's arm that he uses to operate the throttle. The device allows the harness to track intentional arm movements, without exerting any restraining forces, and at the same time applies g-forces through the harness to the pilot's arm that are computed by the aircraft simulator computer. NASA

N72-27272*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WIND TUNNEL MODEL AND METHOD Patent Application
Charlie M. Jackson, Jr. and Dallas G. Summerfield, inventors (to NASA) Filed 19 Jun. 1972 9 p
(NASA-Case-LAR-10812-1; US-Patent-Appl-SN-263815) Avail: NTIS HC $3.00 CSCL 14B

A method for designing a wind tunnel model airfoil with integrally formed pressure measurement orifices is described. Diverse length small diameter tubes are clamped in fixed spaced relationship by clamps to form an array. The tubes are placed with an equal length of each tube extending from one side of the airfoil, and uneven lengths extending from the other side. The even length tubes are at the base of the constructed airfoil while the uneven lengths extend to varying distances within the airfoil toward the leading edge. The airfoils are formed by casting a solidifiable material so as to completely encase the uneven portion of the tubes. After finishing and polishing the airfoil, an X-ray photo is taken to precisely locate the individual tubes. The X-ray is then used as a template to drill transverse holes to intersect perpendicularaly with the tubes. Holes are positioned at the points on the airfoil where pressure measurements are desired during wind tunnel test, and connected to conventional pressure measurement instrumentation. F.O.S.

N72-27273*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DESIGN OF A MACH 8.0 AXISYMMETRIC NOZZLE FOR A HYPERSONIC TEST FACILITY
Joseph L. Sims and Robert F. Elkin 24 May 1972 24 p refs
(NASA-TM-X-64664) Avail: NTIS HC $3.25 CSCL 14B

An axisymmetric nozzle has been designed to produce test section flow at a Mach number of 8.0 for use in a hypersonic test facility at MSFC. Nominal design conditions used to calculate the viscous correction to the wall contour were selected from the results of a parametric boundary layer investigation so that the widest possible range of satisfactory operating conditions could be obtained. Coordinates for the nozzle are presented in a tabular form suitable for design and manufacturing. The basic analysis techniques have been used to generate results to compare with experimental data from a facility at Langley Research Center. The agreement was reasonably good. Author

N72-27274*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LUNAR ROVING VEHICLE MAGNETIC TESTS Final Report
J. C. Boyle Oct. 1971 45 p
(NASA-TM-X-65927; X-325-72-179) Avail: NTIS HC $4.25 CSCL 13F

The qualification model of the lunar roving vehicle (LRV) was tested in the Spacecraft Magnetic Test Facility (SMTF) at the GSFC Magnetic Test Site. Magnetic field measurements were made, both with the vehicle in its as received state and also subsequent to final deperm treatment. These measurements, together with information supplied to GSFC regarding the magnetic moment of the astronaut's extravehicular mobility units (EMU's) were used to calculate 0.5 nanotesla (gamma) contours around the LRV. The results are tabulated. Magnetic field measurements were also made with various items of LRV equipment operational. No significant changes were noted, except during operation of the vehicle wheels. Author

N72-27275# Kyoto Univ. (Japan). Dept. of Aeronautical Engineering.
STUDIES ON HYPERVELOCITY MODEL LAUNCHER
G. Kamimoto, A. Tsukamoto, and K. Otsuji May 1972 63 p refs
(CP-34) Avail: NTIS HC $5.25

The technique of launching aerodynamic models at hypersonic speeds with a helium-operated, heavy-piston-type, two-stage, light-gas launcher is discussed. The theoretical design of a launcher to give constant acceleration to the model is presented. A computer study for predicting the launcher performance is conducted using a one-dimensional hydrodynamics computer code. The performance of the launcher is studied experimentally, and the optimization is investigated. Author

N72-27276# European Space Research and Technology Center, Noordwijk (Netherlands).
METALLURGICAL FACILITIES AT ESTEC
B. D. Dunn Paris ESRO Apr. 1972 39 p
(ESRO-TM-153-ESTEC) Avail: NTIS HC $4.00

The metallurgical facilities primarily give functional support to the ESRO satellite projects in the form of metallographic analysis, heat treatment of special alloys and mechanical and nondestructive testing. The work and related in-house equipment are briefly described and certain metallurgical problems dealt with in the past are pictorially presented. Author (ESRO)

N72-27277# Rocket Propulsion Establishment, Westcott (England).
THE DESIGN OF A STAND TO MEASURE THRUST ALIGNMENT IN SOLID PROPELLENT ROCKET MOTORS
D. S. Dean, E. A. Lyons, and D. R. Norman Aug. 1971 31 p ref
(RPE-TR-71/4; BR27218) Avail: NTIS HC $3.75

A thrust stand and calibration system is described by which the direction of the thrust vector of a rocket motor can be resolved over consecutive 50 msec intervals to within 0.7 milliradian. The angle of the overall impulse vector can be measured to 0.5 milliradian. Methods of improving the accuracy of the system are discussed. Author (ESRO)

N72-27278# Naval Aerospace Recovery Facility, El Centro, Calif. Crew Systems Dept.
PILOT CONTROLLED DYNAMIC SPIN SIMULATION OF THE F-4 PHANTOM JET ON THE HUMAN CENTRIFUGE Final Report
Emma Fessenden, Robert A. Hall, and Richard J. Crosbie 22 Nov. 1971 99 p refs
(AD-739326; NADC-CS-7111) Avail: NTIS CSCL 01/3

A successful dynamic spin simulation was completed on the human centrifuge which includes a realistic (dynamic) control stick feel system, and a dynamic out-the-windshield display system. The simulator has an actual F-4 cockpit with dynamic flight instruments and was operated by pilots through a closed loop computer simulation of the aerodynamics of the F-4. The evaluation of the simulator by knowledgeable pilots has given insight into the value of the constituents of a spin simulator. A combination of three modes of motion and the presence and absence of a dynamic closed loop visual display constituted the major variants for analysis. The methods used for the simulation of aerodynamic equations, the centrifuge drive, the instrument drive and the feel system are detailed in the report. A comprehensive study was made of the parameters generated in the spin for the significance of motion and the visual display on the pilots actions. Author (GRA)

N72-27279# Cornell Aeronautical Lab., Inc., Buffalo, N.Y. Flight research Dept.
DEVELOPMENT, DESIGN AND FABRICATION OF THE TOTAL IN-FLIGHT SIMULATOR (TIFS) Final Technical Report, Feb. 1967 - Oct. 1970
P. A. Reynolds, J. C. Seal, and G. J. Fabian Aug. 1971 237 p refs
(Contract F33615-67-C-1157; AF Proj. 684B)
(AD-739230; AFFDL-TR-71-77) Avail: NTIS CSCL 01/3

The TIFS research airplane, the most advanced in-flight simulation vehicle yet developed, was designed to provide total in-flight simulation. This capability depends on two basic features of the aircraft. First is the addition of an evaluation cockpit which is entirely separate from the normal airplane's safety pilots' cockpit. Second is the control by a variable stability system of not only the moments about all three axes, but also the forces acting along the three axes. The report describes the TIFS airplane through the completion of functional flight tests in October 1970. The subjects treated are structures, electronics, hydraulics, aerodynamics, flutter, and model following. Author (GRA)

N72-27280# Department of Transportation, Washington, D.C.
NATIONAL TRANSPORTATION PLANNING MANUAL (1970 - 1990). MANUAL D: AIRPORTS AND OTHER INTERCITY TERMINALS
Apr. 1971 118 p refs
(PB-207529; OMB-04-S71002) Avail: NTIS HC $3.00 CSCL 13F

The manual is the fourth in a series prepared by the U.S. Department of Transportation for conducting the 1972 national transportation needs study. Three general types of information are concerned: a transportation needs summary, capital improvement program summaries, and individual airport information. GRA

N72-27281# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE MEGAMPERE ACCELERATOR
G. Askaryan 15 Dec. 1971 19 p refs Transl. into ENGLISH from Nauki i Zhizn (USSR), no. 12, 1969 p 27-32
(AD-739294; FTD-HT-23-1352-71) Avail: NTIS CSCL 20/7

A megampere accelerator is one in which the beam current is measured in millions of amperes. Such machines do not yet exist; however, beams close to megamperes have been attained. It is possible to focus beams in metal tubes and even bend them, thus yielding amplifications which are quite high. Targets at which these beams have been directed show effects similar to lightning, demonstrating the high power of these beams. Such phenomena will be important in laser technology. Author (GRA)

N72-27282# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
WIND TUNNEL SIMULATION AND PROTOTYPE STUDIES OF BARRIER FLOW PHENOMENA
J. D. Horn, G. S. Campbell, A. L. Wallis, and R. G. McIntyre (Tex. Univ., El Paso) Ft. Monmouth, N. J. ECOM Dec. 1971 40 p refs
(DA Proj. 1T0-62111-A-126)
(AD-739484; ECOM-5416) Avail: NTIS CSCL 14/2

Design criteria were sought for a wind barrier to be erected along the rain erosion test section of the rocket sled test track at Holloman Air Force Base, New Mexico. Simulated rainfall at the test facility is highly sensitive to cross-wind components, particularly those exceeding one m/s. Research on wind barrier configurations to provide protection for the test track rainfield included both wind tunnel and prototype studies. Results were obtained with a prototype barrier in the open atmosphere and wind tunnel simulation models at scaling ratios of 1:3 and 1:40, giving wind defects for an optimum barrier design of 35% permeability. A barrier design is proposed which would markedly increase the number of days during which the wind-sensitive rain field simulation facility of the test track could be successfully used. GRA

N72-27283# Navy Clothing and Textile Research Unit, Natick, Mass.
HYDROSPACE SIMULATOR FACILITY FOR MATERIALS TESTING
Norman F. Audet Feb. 1972 32 p refs
(AD-739695; TR-99; Rept-10-71) Avail: NTIS CSCL 14/2

The Navy Clothing and Textile Research Unit (NCTRU) developed a hydrospace simulator facility for testing material properties at sea depths to 1,000 FSW. The facility contains three testers to study material thickness, stretch-flex, and thermal conductance properties from normal ambient pressures to 1,000 FSW. The equipment complex also integrates the gas control and instrumentation hardware, testers, and pressure chamber equipment necessary for studying the material properties outlined. The material properties which can be studied with this facility are of significant importance in the development and/or screening of materials suitable for deep sea swimmers' suits. Author (GRA)

N72-27284# Federal Aviation Agency, Washington, D.C. Airports Service.
PARK FALLS MUNICIPAL AIRPORT, PRICE COUNTY, PARK FALLS, WISCONSIN Final Environmental Impact Statement.
10 Apr. 1972 38 p Supersedes PB-204025-D
(PB-204025-F; ELR-4187) Avail: NTIS HC $3.00 CSCL 13B

The report describes the proposal to construct a paved 75 x 3200 ft runway with marking; construct a paved 30 x 130 ft taxiway with marking; construct a paved 100 x 200 ft apron with tie downs; construct a 24 x 1225 ft private entrance road; install low intensity lighting system. The adverse impacts are clearing of 8.8 acres of trees. Author (GRA)

N72-27462 Laboratoires d'Electroniqúe et de Physique Appliquee, Limeil-Brevannes (France).
GROUND SIMULATORS FOR TESTING INFRARED HORIZON SCANNERS [SIMULATEURS DE TERRE POUR L'ESSAI DES SENSEURS D'HORIZON INFRAROUGE]
J. J. Hunzinger *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 335-345 In FRENCH (For availability see N72-27435 18-14)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N72-27285 California Inst. of Tech., Pasadena.
A SMALL PERTURBATION THEORY FOR CYCLOIDAL PROPELLERS Ph.D. Thesis
Edwin Charles James 1971 475 p
Avail: Univ. Microfilms Order No. 72-475

A hydromechanical theory is developed for cycloidal propellers for two limiting modes of operation wherein U much larger than omega R and U much smaller than omega R, with U the rectilinear propeller speed and omega R the rotational blade speed. A first order theory is developed from the basic principles of the kinematics and dynamics of fluid motion and proceeds from the point of view of unsteady hydrofoil theory. Explicit expressions for the instantaneous forces and moments produced by blade motions are presented. On the basis of these results an optimization procedure is carried out which minimizes the energy loss under the constraint of specified mean thrust.
Dissert. Abstr.

N72-27286 Michigan State Univ., East Lansing.
TWO-DIMENSIONAL POTENTIAL FLOW AND BOUNDARY LAYER ANALYSIS OF THE AIRFOIL OF A STOL WING PROPULSION SYSTEM Ph.D. Thesis
James Arthur Albers 1971 151 p
Avail: Univ. Microfilms Order No. 71-31148

The calculated pressure distributions for a particular externally blown flap configuration indicated that the minimum pressure point is near the leading edge (less than 2 percent of chord) of the airfoil with severe adverse pressure gradients at high angles of attack (near 20deg). The results of the boundary layer analysis indicated that the predicted turbulent separation point moved forward from the trailing edge as the angle of attack was increased. Trailing edge separation for the thick wing (t/c= 0.15) propulsion system combination considered was verified by experimental data.
Dissert. Abstr.

N72-27287 Dartmouth Coll., Hanover, N.H.
A NEW VORTEX MODEL FOR FREE BOUNDARY LAYER FLOWS Ph.D. Thesis
Stanley Fleetwood Birch 1971 179 p
Avail: Univ. Microfilms Order No. 72-1699

A new vortex model is presented for describing steady and unsteady free boundary layer flows. The predictions of the model are compared with a large number of analytic solutions for laminar flows and the mean velocity components to turbulent flows and it is shown that the vortex model not only gives a very good approximation to the analytic solution, but that it is capable of describing regions of the flow for which there are no analytic solutions. The model is then developed to describe unsteady flows and the results are compared with experimental results obtained from an experimental study of Karman vortex streets in jets. The results are also compared with experimental results, reported in the literature, for vortex streets in wakes.
Dissert. Abstr.

N72-27288 Purdue Univ., Lafayette, Ind.
AN INVESTIGATION OF THE INTERACTION BETWEEN A SONIC TWO-DIMENSIONAL JET AND A SUPERSONIC PRIMARY STREAM WITH A FAVORABLE PRESSURE GRADIENT Ph.D. Thesis
Richard Dale Guhse 1971 364 p
Avail: Univ. Microfilms Order No. 72-1869

A series of 195 experimental runs were conducted for two-dimensional, sonic, non-reacting, gaseous secondary injection into a supersonic primary stream with a turbulent boundary layer in the presence of a moderately favorable axial pressure gradient. The properties varied were the secondary stagnation temperature, stagnation pressure, injection slot width, injection angle, molecular weight and specific heat ratio, and the primary stream Mach number and static pressure at the injection port. A semi-empirical correlating parameter, based on a momentum balance between the two streams, was deduced which correlated the upstream separation distance for all the experimental runs. This parameter was also used to independently correlate published data for two-dimensional flat plate injection experiments for both laminar and turbulent boundary layer separation.
Dissert. Abstr.

N72-27289 National Lending Library for Science and Technology, Boston Spa (England).
FLUID MECHANICS: A NEW DESCRIPTION OF THE COEFFICIENT OF VISCOSITY OR OF TURBULENT DIFFUSION
J. Gosse 20 Apr. 1972 9 p refs Transl. into ENGLISH from Compt. Rend. Acad. Sci., Ser. A (Paris), no. 271, 21 Dec. 1970 p 1276-1279 In ENGLISH and FRENCH
(NLL-T-1507-(9022.305)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The relationship between the turbulent viscosity coefficient and the characteristic parameters of the turbulent state is studied. Evaluation of various experimental results shows that the mass or heat diffusion coefficients can be identified with the turbulent viscosity coefficient.
G.G.

N72-27290*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
EXPERIMENTAL AND ANALYTICAL INVESTIGATION OF THE COOLANT FLOW CHARACTERISTICS IN COOLED TURBINE AIRFOILS
W. P. Damerow, J. P. Murtaugh, and F. Burggraf Jun. 1972 71 p refs
(Contract NAS3-13499)
(NASA-CR-120883; GE-R72AEG165) Avail: NTIS HC $5.75 CSCL 20D

The flow characteristics of turbine airfoil cooling system components were experimentally investigated. Flow models representative of leading edge impingement, impingement with crossflow (midchord cooling), pin fins, feeder supply tube, and a composite model of a complete airfoil flow system were tested. Test conditions were set by varying pressure level to cover the Mach number and Reynolds number range of interest in advanced turbine applications. Selected geometrical variations were studied on each component model to determine these effects. Results of these tests were correlated and compared with data available in the literature. Orifice flow was correlated in terms of discharge coefficients. For the leading edge model this was found to be a weak function of hole Mach number and orifice-to-impinged wall spacing. In the impingement with crossflow tests, the discharge coefficient was found to be constant and thus independent of orifice Mach number, Reynolds number, crossflow rate, and impingement geometry. Crossflow channel pressure drop showed reasonable agreement with a simple one-dimensional momentum balance. Feeder tube orifice discharge coefficients correlated as a function of orifice Mach number and the ratio of the orifice-to-approach velocity heads. Pin fin data was correlated in terms of equivalent friction factor, which was found to be a function of Reynolds number and pin spacing but independent of pin height in the range tested.
Author

N72-27291*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF CONTACT ANGLE HYSTERESIS ON MOVING LIQUID FILM INTEGRITY
F. F. Simon and Y. Y. Hsu 1972 28 p refs Proposed for presentation at 73d Natl. Meeting of Am. Inst. of Chem. Engr., Minneapolis, 27-30 Aug. 1972
(NASA-TM-X-68071; E-6955) Avail: NTIS HC $3.50 CSCL 20D

A study was made of the formation and breakdown of a water film moving over solid surfaces (teflon, lucite, stainless steel, and copper). The flow rate associated with film formation was found to be higher than the flow rate at which film breakdown occurred. The difference in the flow rates for film formation and film breakdown was attributed to contact angle hysteresis. Analysis and experiment, which are in good agreement, indicated that film formation and film breakdown are functions of the advancing and receding angles, respectively. Author

N72-27292*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PITOT-PRESSURE DISTRIBUTIONS OF THE FLOW FIELD OF A DELTA-WING ORBITER
Joseph W. Cleary May 1972 75 p refs
(NASA-TM-X-62122) Avail: NTIS HC $5.75 CSCL 20D

Pitot pressure distributions of the flow field of a 0.0075-scale model of a typical delta wing shuttle orbiter are presented. Results are given for the windward and leeward sides on centerline in the angle-of-attack plane from wind tunnel tests conducted in air. Distributions are shown for three axial stations X/L = .35, .60, and .98 and for angles of attack from 0 to 60 deg. The tests were made at a Mach number of 7.4 and for Reynolds numbers based on body length from 1,500,000 to 9,000,000. The windward distributions at the two survey stations forward of the body boat tail demonstrate the compressive aspects of the flow from the shock wave to the body. Conversely, the distributions at the aft station display an expansion of the flow that is attributed to body boat tail. On the lee side, results are given at low angles of attack that illustrate the complicating aspects of the canopy on the flow field, while results are given to show the effects of flow separation at high angles of attack. Author

N72-27293# Advisory Group for Aerospace Research and Development, Paris (France).
NUMERICAL METHODS IN FLUID DYNAMICS
J. J. Smolderen, ed. May 1972 328 p refs Partly in ENGLISH and partly in FRENCH
(AGARD-LS-48) Avail: NTIS HC $18.50

Numerical analysis and approximation are considered for gas and fluid flow problems in fluid dynamics. Navier-Stokes and other equations of motion are discussed, as well as various finite element methods. For individual titles, see N72-27294 through N72-27308.

N72-27294 Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
INTRODUCTORY REMARKS
J. J. Smolderen *In* AGARD Numerical Methods in Fluid Dyn. May 1972 8 p (For availability see N72-27293 18-12)

The basic mathematical problems of fluid mechanics are reviewed and the various numerical techniques available to solve partial differential equations are presented. Their advantages and limitations are briefly discussed. Author

N72-27295 Paris Univ. (France).
ON THE NUMERICAL APPROXIMATION OF SOME EQUATIONS ARISING IN HYDRODYNAMICS
J. L. Lions *In* AGARD Numerical Methods in Fluid Dyn. May 1972 13 p refs (For availability see N72-27293 18-12)

Examples are developed of equations arising in hydrodynamics for the following: (1) approximation of systems which are not of the Cauchy-Kowaleska type by systems of that type; (2) the possibilities of splitting the systems of the Cauchy-Kowaleska type; and (3) the splitting of coupled systems. Author

N72-27296 Paris Univ., Orsay (France).
APPROXIMATION OF NAVIER-STOKES EQUATIONS
R. Teman *In* AGARD Numerical Methods in Fluid Dyn. May 1972 6 p refs (For availability see N72-27293 18-12)

Methods of approximation of the full Navier-Stokes equations are discussed. The problem considered is the unsteady flow (and sometimes the steady flow) of an incompressible viscous fluid in a bounded domain. The problem possesses a unique solution in the case of a two-dimensional flow. In the case of a three-dimensional flow, the problem possesses at least one solution, but uniqueness is known only when the vectors f,g, and u sub o are sufficiently small for Re fixed (laminar flow). Three kinds of approximation methods are described: (1) the penalty method, (2) perturbation and fractional step method, and (3) the fractional step method. Author

N72-27297 Laval Univ. (Quebec).
THE APPROXIMATION OF NAVIER-STOKES EQUATIONS FOR VISCOUS INCOMPRESSIBLE FLUIDS [SUR L'APPROXIMATION DES EQUATIONS DE NAVIER-STOKES DES FLUIDES VISQUEUX INCOMPRESSIBLES]
M. Fortin and R. Temin (Paris Univ., Orsay) *In* AGARD Numerical Methods in Fluid Dyn. May 1972 7 p refs In FRENCH (For availability see N72-27293 18-12)

The problem considered is that of nonstationary flow of a viscous incompressible fluid in a bounded domain Omega. If the vector u is designated as the velocity vector, p as pressure, and f as the given forces, the equations of motion are written in the classical manner, in nondimensional form. Initial and limiting condition are also given. The method discussed here is an interpretation of the fractional step method. Transl. by K.P.D.

N72-27298 Laval Univ. (Quebec).
NUMERICAL SOLUTION OF STEADY STATE NAVIER-STOKES EQUATIONS
M. Fortin *In* AGARD Numerical Methods in Fluid Dyn. May 1972 8 p refs (For availability see N72-27293 18-12)

The Navier-Stokes equations of a viscous incompressible fluid in a bounded domain are considered. Only two-dimensional cases are treated, but some results and all numerical schemes may be extended to the three-dimensional flow. Existence and uniqueness of solutions are discussed. The results, especially those concerning uniqueness are used to explain the difficulties encountered in the convergence proofs of the methods. Author

N72-27299 International Business Machines Corp., San Jose, Calif.
NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATIONS AT HIGH REYNOLDS NUMBERS AND THE PROBLEM OF DISCRETIZATION OF CONVECTIVE DERIVATIVES
Jacob E. Fromm *In* AGARD Numerical Methods in Fluid Dyn. May 1972 47 p ref (For availability see N72-27293 18-12)

The essentials of numerical computation of time-dependent, nonlinear fluid flows are discussed. The case under consideration is that of incompressible flow with viscosity, described in terms of a vorticity and stream function. Author

N72-27300 Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Graduate Center.
NUMERICAL ANALYSIS OF VISCOUS ONE DIMENSIONAL FLOWS
G. Moretti and M. D. Salas *In* AGARD Numerical Methods in Fluid Dyn. May 1972 20 p refs Presented at Meeting on Appl. of Numerical Methods in Mod. Gasdyn., Novosibirsk, USSR, 17-24 Aug. 1969 (For availability see N72-27293 18-12)

The flow of a viscous, heat-conducting gas produced by an accelerating piston is analyzed numerically. The formation of a shock in a viscous flow is studied. A discussion of accuracy and practicality of a numerical analysis of the problem is given. It is concluded that the assumption of a shock as a sharp discontinuity is the only practical way to handle flows whose Reynolds number per unit length is higher than 100. Author

N72-27301 Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Graduate Center.
A CRITICAL ANALYSIS OF NUMERICAL TECHNIQUES: THE PISTON DRIVEN INVISCID FLOW
G. Moretti *In* AGARD Numerical Methods in Fluid Dyn. May 1972 31 p refs (For availability see N72-27293 18-12)
(Contract Nonr-839(38); ARPA Order 529)

An analysis of procedures for the computation of one-dimensional shocked flow was made, in order to show the inconveniences of computing finite differences across a discontinuity and to prove that the use of the equations of motion in conservation form does not make the results more accurate. A technique was developed to treat one-dimensional inviscid problems, and it is applied to the problem of an accelerating piston. Ways to predict the formation of a shock and to follow its evolution are given. Author

N72-27302 Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Graduate Center.
TRANSIENT AND ASYMPTOTICALLY STEADY FLOW OF AN INVISCID, COMPRESSIBLE GAS PAST A CIRCULAR CYLINDER
G. Moretti *In* AGARD Numerical Methods in Fluid Dyn. May 1972 19 p refs (For availability see N72-27293 18-12)
(Contract DAHC04-69-C-0077)

A numerical analysis is made of the inviscid flow produced by a cylinder which accelerates from a state of rest to a constant, subsonic speed in a gas at rest. All features of the numerical solution are explained on physical grounds. Ways are suggested to compute steady subsonic flows around obstacles with a maximum accuracy and a minimum computational time.
Author

N72-27303 Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Graduate Center.
THE BLUNT BODY PROBLEM FOR A VISCOUS RAREFIED GAS FLOW
G. Moretti and M. D. Salas *In* AGARD Numerical Methods in Fluid Dyn. May 1972 15 p refs (For availability see N72-27293 18-12)
(Contract Nonr-839(34))

A time-dependent technique developed for inviscid blunt body flows was extended to analyze the viscous layer regime (a rarefied gas situation where viscosity affects most of the shock layer but not the shock wave itself). Navier-Stokes equations were used. To maintain accuracy, the (nonlinear) mesh spacing was adjusted automatically to the nature of the velocity distribution between shock and body. In this way, a wide range of Reynolds numbers can be scanned. The technique could also be used at high Reynolds numbers, when the shock layer is practically inviscid and viscous effects are confined to a boundary layer. Discussion of numerical experiments is given.
Author

N72-27304 Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Graduate Center.
THE CHOICE OF A TIME DEPENDENT TECHNIQUE IN GAS DYNAMICS
G. Moretti *In* AGARD Numerical Methods in Fluid Dyn. May 1972 30 p refs (For availability see N72-27293 18-12)
(Contract Nonr-839(34))

A definition of the word technique, as related to numerical computations of time-dependent problems in gas dynamics, is given. Requirements of accuracy, economy, and flexibility are considered. A technique which attempts to satisfy them is presented. Emphasis is put on the consistency of the numerical procedure with the physical problem. The concepts of consistency, convergence, and truncation error are reexamined. Certain breakdowns in accuracy occurring in regions of continuous flow are explained. The physical role played by discontinuities and its numerical counterpart are discussed. Author

N72-27305 Cambridge Univ. (England). Engineering Dept.
APPLICATION OF FINITE ELEMENT METHODS IN FLUID DYNAMICS
D. H. Norrie and G. deVries (Calgary Univ., Alberta) *In* AGARD Numerical Methods in Fluid Dyn. May 1972 43 p refs (For availability see N72-27293 18-12)

The classification of finite element methods is presented. Generalized Lagrangian and Hermitian shape functions are discussed in relation to the finite element approximation. Variational finite element methods are considered for equilibrium, eigenvalue, and propagation problems. Direct finite element methods are also discussed. Steady and unsteady potential flow, porous media flows, viscous flow, general fluid flows, and other fluid applications are reviewed. The cell finite element method is also considered. K.P.D.

N72-27306 Boeing Co., Seattle, Wash.
COMPUTATIONAL METHODS FOR INVISCID TRANSONIC FLOWS WITH IMBEDDED SHOCK WAVES
Earll M. Murman *In* AGARD Numerical Methods in Fluid Dyn. May 1972 36 p refs (For availability see N72-27293 18-12)

Time-dependent techniques, relaxation methods, and approximate solutions are considered, with emphasis placed on the latest developments. Computing times, accuracy, and proper treatment of shock waves are stressed. Author

N72-27307 Freiburg Univ. (West Germany).
NUMERICAL TREATMENT OF TIME DEPENDENT THREE DIMENSIONAL FLOWS
K. G. Roesner *In* AGARD Numerical Methods in Fluid Dyn. May 1972 31 p refs (For availability see N72-27293 18-12)

The numerical treatment of three-dimensional time-dependent flows of an ideal gas with constant ratio of specific heats was investigated. It is assumed that inside the flow field, no discontinuities occur. As boundaries, fixed or moving rigid body surfaces and shock waves were allowed. This type of gas flow is described by the Euler equations with appropriate initial and boundary conditions. The mathematical tools applied to this gas dynamical problem are: (1) the method of characteristics, and (2) the method of fractional steps. The application of these methods is discussed for some definite problems, one being the time-dependent inlet flow through a nozzle with a three-dimensional shape of its contour, the other the time-dependent supersonic flow around blunt bodies with various shapes of their surfaces. A comparison was made between the two methods with respect to their effectiveness. Author

N72-27308 Societe Grenobloise d'Etude et d'Applications Hydrauliques (France).
PETULA (PROGRAM FOR TURBULENT OR LAMINAR FLOWS): AN EXAMPLE OF A COMPLEX MATHEMATICAL MODEL IN FLUID MECHANICS [PETULA (PROGRAMME D'ECOULEMENTS TURBULENTS OU LAMINAIRES): UN EXEMPLE DE MODELE MATHEMATIQUE COMPLEXE EN MECHANIQUE DES FLUIDES]
M. F. Gauthier *In* AGARD Numerical Methods in Fluid Dyn. May 1972 13 p refs In FRENCH (For availability see N72-27293 18-12)

The model definition, structure, and empirical parameter identification are presented. Limiting conditions and adaptive coordinate systems are considered. Convergence is considered for the nonlinear model. Transl. by K.P.D.

N72-27309# Lockheed Missiles and Space Co., Palo Alto, Calif.
UNSTEADY VISCOUS FLUID MOTION IN ELASTIC CYLINDRICAL SHELL
N. A. Kilchevskii [1972] 20 p refs Transl. into ENGLISH from the book "Mekhanika Sistem Obolochka-Zhidkost-Nagretyi Gaz" Kiev, Naukova Dumka, 1970 p 281-306
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The problem of viscous compressible fluid motion in a domain bounded by two coaxial elastic cylindrical shells was solved by the Green's function method. The problem of two-dimensional incompressible fluid motion in a finite elastic cylindrical shell is also considered. Author

N72-27310*# General Electric Co., Philadelphia, Pa.
CONDUCTING FLOW ELECTROPHORESIS IN THE SUBSTANTIAL ABSENCE OF GRAVITY Patent Application
Richard N. Griffin and Louis R. McCreight, inventors (to NASA) Filed 31 May 1972 14 p Sponsored by NASA
(NASA-Case-MFS-21394-1; US-Patent-Appl-SN-258171) Avail: NTIS HC $3.00 CSCL 20D

A zero g, constant flow electrophoretic separating apparatus comprises a deflecting member to spread the carrier fluid across a conduit, separation electrodes spaced apart along the conduit, and an end wall with a valve located in the conduit behind the separation electrodes from which layers of the carrier and sample may be extracted. The electrode electrolyte is separated from the carrier and continually circulated and cleaned. NASA

N72-27311*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NUMERICAL SOLUTIONS OF THE NAVIER-STOKES EQUATIONS FOR THE SUPERSONIC LAMINAR FLOW OVER A TWO-DIMENSIONAL COMPRESSION CORNER
James E. Carter Washington Jul. 1972 81 p refs
(NASA-TR-R-385; L-8306) Avail: NTIS HC $3.00 CSCL 20D

Numerical solutions have been obtained for the supersonic, laminar flow over a two-dimensional compression corner. These solutions were obtained as steady-state solutions to the unsteady Navier-Stokes equations using the finite difference method of Brailovskaya, which has second-order accuracy in the spatial coordinates. Good agreement was obtained between the computed results and wall pressure distributions measured experimentally for Mach numbers of 4 and 6.06, and respective Reynolds numbers, based on free-stream conditions and the distance from the leading edge to the corner. In those calculations, as well as in others, sufficient resolution was obtained to show the streamline pattern in the separation bubble. Upstream boundary conditions to the compression corner flow were provided by numerically solving the unsteady Navier-Stokes equations for the flat plate flow field, beginning at the leading edge. The compression corner flow field was enclosed by a computational boundary with the unknown boundary conditions supplied by extrapolation from internally computed points. Author

N72-27312*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DISCRETE SONIC JETS USED AS BOUNDARY-LAYER TRIPS AT MACH NUMBERS OF 6 AND 8.5
David R. Stone and Aubrey M. Cary, Jr. Washington Jul. 1972 51 p refs
(NASA-TN-D-6802; L-8215) Avail: NTIS HC $3.00 CSCL 20D

The effect of discrete three-dimensional sonic jets used to promote transition on a sharp-leading-edge flat plate at Mach numbers of 6 and 8.5 and unit Reynolds numbers as high as 2.5 x 100,000 per cm in the Langley 20-inch hypersonic tunnels is discussed. An examination of the downstream flow-field distortions associated with the discrete jets for the Mach 8.5 flow was also conducted. Jet trips are found to produce lengths of turbulent flow comparable to those obtained for spherical-roughness-element trips while significantly reducing the downstream flow distortions. A Reynolds number based upon secondary jet penetration into a supersonic main flow is used to correlate jet-trip effectiveness just as a Reynolds number based upon roughness height is used to correlate spherical-trip effectiveness. Measured heat-transfer data are in agreement with the predictions. Author

N72-27313*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONVECTION IN THE TANKS OF A ROTATING SPACECRAFT
Washington Jun. 1972 147 p refs
(NASA-TR-R-386; A-4224) Avail: NTIS HC $3.00 CSCL 20D

A general study of convection and mixing of a stratified fluid in a rotating container is described, with application to the special problem of fluid heating and convection in a spacecraft tank. The analysis was based on a set of approximate equations for the Navier-Stokes description of fluid convection with small density variations in a rotating system, including effects of body forces due to temperature stratification (caused by a heater) and arbitrary time-dependent rotation of the tank about a noncentral axis. An efficient numerical finite difference scheme and computational method are described for the convection of vorticity and energy in a two-dimensional tank. Special procedures were developed for analysis of the thermodynamic states resulting from the approximate flow equations derived for small density variations. Results of the numerical simulation are presented for studying the effectiveness of rotation maneuvers in mixing stratified oxygen in the tanks of an Apollo spacecraft. Significant effects of the rotation maneuvers are discussed, including the reduction of the potential for pressure collapse. Author

N72-27314*# Scientific Translation Service, Santa Barbara, Calif.
A DIFFERENTIAL METHOD FOR SOLVING THE BOUNDARY LAYER EQUATION FOR STEADY LAMINAR INCOMPRESSIBLE FLOW
W. Schoenauer Washington NASA Jul. 1972 36 p refs Transl. into ENGLISH from Ing.-Arch. (West Germany), v. 33, 1964 p 173-189
(Contract NASw-2035)
(NASA-TT-F-14363) Avail: NTIS HC $4.00 CSCL 20D

An implicit differential method is given for the laminar incompressible, steady boundary layer at a solid impermeable wall. It can be shown that perturbations are reduced after a few steps of calculation. The method was tested practically with a large number of examples. An electronic computer is required, but the method is well suited for programming. Two-digit precision can be attained for the shear stress at low cost. Author

N72-27315*# Translation Consultants, Ltd., Arlington, Va.
INTERACTION OF AN ELASTIC BOUNDARY WITH THE VISCOUS SUBLAYER OF A TURBULENT BOUNDARY LAYER
B. N. Semenov Washington NASA Jul. 1972 9 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Tekhn. Fiz. (Moscow), no. 3, May-Jun. 1971 p 58-62
(Contract NASw-2038)
(NASA-TT-F-14391) Avail: NTIS HC $3.00 CSCL 20D

The wall region of a turbulent boundary layer plays a significant role in the formation of drag, and intense generation of turbulence occurs in this region. The interaction of an elastic boundary with the viscous sublayer in order to reduce Reynold stresses, and to reduce the drag correspondingly, is studied. The general case could not be investigated, so the problem is solved within the limitations imposed by Sternberg by considering the theory of the viscous sublayer in a turbulent flow near a solid, smooth, wall. Author

N72-27316# National Aerospace Lab., Tokyo (Japan).
DEVELOPMENT OF TURBULENT BOUNDARY LAYERS ALONG THE CURVED WALLS OF AN ANNULAR

DIFFUSING PASSAGE
Shoichi Fujii and Theodore H. Okiisi (Iowa State Univ., Ames) Feb. 1972 14 p refs
(NAL-TR-278T) Avail: NTIS HC $3.00

Turbulent boundary layer development along the curved walls of an axisymmetric diffusing annulus was determined experimentally and compared with results calculated using a form of the von Karman momentum integral boundary layer equation and several sets of simple auxiliary equations. Based on the comparisons made, one iterative solution method for predicting curved wall annular diffuser boundary layer growth that yields fair results is proposed. Author

N72-27317# National Aerospace Lab., Tokyo (Japan).
A DESCRIPTION OF THE IDEAS UNDERLYING A COMPUTER PROGRAM FOR PREDICTING THE AEROFOIL PRESSURE DISTRIBUTIONS IN SUBCRITICAL VISCOUS FLOW
Masao Ebihara, Youji Ishida, and Tokio Okonogi Nov. 1971 18 p refs In JAPANESE; ENGLISH summary
(NAL-TR-248) Avail: NTIS HC $3.00

The calculation is based on a compressibility correction formula and on the boundary layer camber model to account for viscous effects. The process by which the modification is effected is explained and the limitation of the boundary layer camber model is discussed. Comparison of the computed results with available experimental data indicates that the method gives results with an accuracy sufficient for most practical applications. Author

N72-27318# National Aerospace Lab., Tokyo (Japan).
A STUDY OF SUBSONIC, TWO-DIMENSIONAL WALL-INTERFERENCE EFFECT IN A PERFORATED WIND TUNNEL WITH PARTICULAR REFERENCE TO THE NAL 2 M BY 2 M TRANSONIC WIND TUNNEL: INAPPLICABILITY OF THE CONVENTIONAL BOUNDARY CONDITION
Masao Ebihara Jan. 1972 29 p refs
(NAL-TR-252T) Avail: NTIS HC $3.50

An analysis was carried out on the subsonic, two-dimensional wall interference effects in a perforated wind tunnel based on the conventional theoretical model. An attempt was made to find the value of the porosity parameter for the 20%-open-area ratio test section of a 2 m x 2 m transonic wind tunnel by combining the results of the analysis with pressure distribution data on several airfoil models obtained using this test section. It was found that no meaningful results can be achieved by this procedure for the value of the porosity parameter. The cause of the failure is ascribed to the inappropriateness of the boundary condition in the theoretical model employed. An alternative form of the boundary condition is suggested based on experimental observations of flow in the proximity of perforated boundaries. Author

N72-27319# Kyoto Univ. (Japan). Dept. of Aeronautical Engineering.
MEASUREMENT OF ELECTRON TEMPERATURE ALONG A STAGNATION-POINT STREAM LINE IN A PARTIALLY IONIZED GAS
Shuji Sugimoto and Michio Nishida May 1972 28 p refs
(CP-35) Avail: NTIS HC $3.50

The electron temperatures along the stagnation point streamline ahead of a blunt body in a nonequilibrium, partially ionized gas was measured at Mach numbers of 4.4 with the Langmuir probe technique. The experiments were carried out for three cases of the surface temperature, which were produced by using water, helium gas and liquid nitrogen as coolant. The measured electron temperatures were compared with the calculated results for the case of a viscous shock layer. The calculations were carred out, taking into consideration the interaction of the electron thermal layer ahead of the shock and the viscous shock layer. Author

N72-27320# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
EFFECT OF TRANSVERSE DISTURBANCES ON HEAT TRANSFER IN A LAMINAR AXISYMMETRIC BOUNDARY LAYER
R. D. Small and J. Rom Feb. 1972 34 p refs
(Contract F61052-70-C-0005)
(TAE-146) Avail: NTIS HC $3.75

The effect of a periodic crossflow velocity on the heat transfer characteristics of a laminar axisymmetric boundary layer has been investigated. The three dimensional axisymmetric boundary layer equations were solved using a perturbation expansion technique to mathematically separate the standard boundary layer flow from the imposed vortex flow. The sets of equations were put into an almost two dimensional form using a Mangler type transformation and were reduced to ordinary differential equations with appropriate asymptotic expansions. Agreement between theory and recently obtained experimental heat transfer data for a cone-cylinder in supersonic and hypersonic flow is found to be good. Author

N72-27321# Central Electricity Generating Board, London (England). Information Services.
JET IMPINGEMENT AND DIFFUSION, 1961 - 1971
R. W. Prior, comp. May 1972 17 p refs
(CE-Bibl-224) Avail: NTIS HC $3.00

A bibliography of reports on the subjects of jet impingement and diffusion is presented. Subjects discussed are: (1) rotational solutions of Euler equations, (2) impingement of a liquid jet on the surface of a heavier liquid, (3) heat transfer between a pulsating impinging jet and a flat surface, (4) unified analysis of turbulent jet mixing, and (5) aerodynamics of gas combustion. Author

N72-27322# Joint Publications Research Service, Arlington, Va.
LAMINAR MULTICOMPONENT BOUNDARY LAYER WITH HIGH RATES OF INJECTION
E. A. Gershbeyn 6 Jul. 1972 15 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 1, 1970 p 64-73
(JPRS-56437) Avail: NTIS HC $3.00

The effect of high injection rates on a laminar boundary layer is investigated in connection with the re-entry of bodies into planet atmospheres at second and higher space velocities. The asymptotic solution of the equations of two-dimensional laminar boundary layer is presented for an arbitrary N-component gas mixture at high injection rates from the surface of the body. Author

N72-27323# Institut Franco-Allemand de Recherches, St. Louis (France).
STUDY OF THE RADIAL DISTRIBUTION OF THE DENSITY AND THE REFRACTIVE INDEX IN THE WAKE OF A SPHERE IN HYPERSONIC FLIGHT: APPLICATION TO THE CHOICE OF AN APPROXIMATE SHAPE OF THE SHOCK WAVE [ETUDE DE LA REPARTITION RADIALE DE MASSE VOLUMIQUE ET D'INDICE DE REFRACTION DANS LE SILLAGE D'UNE SPHERE EN VOL HYPERSONIQUE. APPLICATION AU CHOIX D'UNE FORME APPROCHEE DE L'ONDE DE CHOC]
L. Oudin, B. C. Jaeggy, M. Jeanmaire, G. Koerber, and F. Schlosser 2 Apr. 1971 64 p refs In FRENCH
(ISL-16/71) Avail: NTIS HC $5.25

An interferential schlieren process was used to determine the radial density distribution, assumed to be proportional to the refractive index, in the wake of a spherical shell in hypersonic flight at a length of about 60 calibers behind the projectile. A set of experimental curves was derived and compared with values obtained by an approximate numerical method consisting of an isentropic expansion down to ambient pressure. This comparison indicates that the most suitable shock wave model is the Gregorek-Korkan. ESRO

N72-27324# Institut Franco-Allemand de Recherches, St. Louis (France).
GAS DYNAMIC STUDIES CARRIED OUT IN A SHOCK TUBE BY MEANS OF A HIGHLY SENSITIVE LASER INTERFEROMETER [GASDYNAMISCHE UNTERSUCHUN-

GEN IM STOSSROHR MIT EINEN HOCHEMPFINDLICHEN LASER-INTERFEROMETER]
G. Smeets and A. George 14 Jun. 1971 42 p refs In GERMAN
(ISL-14/71) Avail: NTIS HC $4.25

The technical specifications of an experimental design for laser interferometry of gas dynamics are given. By operating an assembly of a helium-neon laser to a p-i-n photodiode used as detector, it is possible to measure optical path variations with a 0.1 A accuracy and a 20 ns time resolution. Some applications to gas flow measurements are described and discussed, and advantages of this technique are evidenced. ESRO

N72-27325# Laboratorium fur Betriebsfestigkeit, Darmstadt (West Germany).
CUMULATIVE FREQUENCY DISTRIBUTIONS OF PRESSURE VARIATIONS IN MINERAL OIL PIPELINES [HAEUFIGKEITSVERTEILUNGEN DER FOERDERDRUCKSCHWANKUNGEN IN MINERALOELFERNLEITUNGEN]
O. Buxbaum and A. Uhde Fraunhofer Ges. Nov. 1971 42 p refs In GERMAN Prepared jointly with Deut. Ges. fuer Mineraloelwiss. und Kohlechem.
(FB-93) Avail: NTIS HC $4.25

Pressure variations were recorded continuously at several stations of five mineral oil pipelines and analyzed statistically. These results are used to develop a method for derivation of cumulative frequency distributions of pressure variations. The pressure variations may be determined for any point of a pipeline with an accuracy that is satisfactory for a fatigue strength evaluation, if the hydraulic operational conditions and the time portions with which they occur are known. Author (ESRO)

N72-27326# Naval Ordnance Lab., White Oak, Md.
WAKE TRANSITION DATA BEHIND 22-DEGREE HALF-ANGLE CONES AT FREE-STREAM MACH NUMBER EQUALS 9.0
Charles J. Infosino and Robert A. Leverance 21 Jan. 1972 42 p refs
(AD-739318; NOLTR-72-38) Avail: NTIS CSCL 16/3

A double pass schlieren photographic system was used to determine the location of laminar-turbulent transition in the wake of 22-degree half angle sharp cones. The measurements were conducted at M = 9 over a range of Reynolds numbers from 15,000 to 150,000. Transition distances from 7 to 200 body diameters were observed. The data are compared with previous wake transition results. GRA

N72-27327# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
DRAG COEFFICIENTS OF SPHERES IN HYPERSONIC NON-CONTINUUM FLOW Final Report, 1 Oct. 1968 - 31 Jul. 1970
John F. Wendt 30 Nov. 1971 48 p refs
(Contract F61052-69-C-0024; AF Proj. 6670)
(AD-739250; AFCRL-72-0126) Avail: NTIS CSCL 16/3

A modulated force probe with a sensitivity in the microgram range was employed to measure the drag forces on spheres in the Mach 5 range with an RMS error of + or - 1 percent. Flow properties in the free jet were used to calculate sphere drag coefficients. The resulting values cover the flow regimes from near-free-molecule to transitional. A correlation parameter, an effective Knudsen number based on body-free stream molecular collisions, is shown to provide a reasonable correlation for a large variety of sphere drag measurements. GRA

N72-27328# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINING THE EXTENT OF THE TRANSITION ZONE AND THE RULES FOR HEAT TRANSFER IN IT WITH MIXED AIR FLOW IN PIPES
E. P. Dyban and E. Ya. Epik 15 Dec. 1971 12 p refs Transl. into ENGLISH from Teplofiz. i Teplotekhn. (USSR), no. 17, 1970 p 21-27
(AD-739210; FTD-HT-23-1300-71) Avail: NTIS CSCL 20/4

Results are shown of an experimental study of heat exchange during mixed flow of air in pipes for two types of inlet devices: a conical duct, a Vitoshinski nozzle. The boundaries of the transition region with respect to pipe length and Reynolds number are determined for both inlet devices. The feature of heat exchange in the transition region is described with emphasis on the variation of the Reynolds number's power exponent. GRA

N72-27329# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFLUENCE OF MIXING OF A JET WITH THE SURROUNDING AIR UPON A PROFILE WITH A JET FLAP
Zdenek Skoda 7 Dec. 1971 14 p refs Transl. into ENGLISH from Zprav. Vyzk. Zkusebni Letecky Ustav (Prague), no. 3, 1969 p 29-32
(AF Proj. 7343)
(AD-739205; FTD-HC-23-320-71) Avail: NTIS CSCL 20/4

The article concerns the influence that the mixing of a jet with the ambient air has on the flow around an aerofoil with a jet flap. The problem is solved on the basis of the theory of thin aerofoils and the mixing of the jet with the ambient air is replaced by the equivalent distribution of sinks on the projection of the jet axis on to the x axis. The change of the circulation around the aerofoil caused by the sinks is very small. From experiments it is known that mixing influences the velocity distribution around the aerofoil. It is shown that this mixing causes a change of the sum of velocities above and below the aerofoil. If the linearized theory is used, this change does not depend on the shape of the aerofoil and depends only on the jet momentum coefficient. The real aerofoil with a jet flap is equivalent to a thicker aerofoil around which the flow is not influenced by the mixing of the jet with the ambient air. Author (GRA)

N72-27330# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN APPROXIMATE METHOD FOR CALCULATING THE MINIMUM SUCTION RATE THAT EXCLUDES SEPARATION FOR THE BOUNDARY LAYER OF A SEMI-BOUNDED STREAM
A. M. Mkhitaryan and A. P. Girol 17 Dec. 1971 12 p ref Transl. into ENGLISH from Samoletostr. Tekh. Vozdush. Flota (Kharkov), no. 17, 1970 p 14-18
(AF Proj. 1370)
(AD-739222; FTD-HT-23-1233-71) Avail: NTIS CSCL 20/4

The article discusses development of a method of calculating the lowest suction rate that would prevent laminar boundary layer separation from a curvilinear porous surface situated in a jet flow expelled from a thin slot into a slipstream. The method is based on the use of a dimensionless momentum equation for the boundary layer and of a velocity profile in the form of a fourth order polynomial. The maximum velocity at the interface between the boundary layer and the main flow is determined from an integral momentum relation for the main flow. GRA

N72-27331# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EMPIRICAL FORMULAS FOR AERODYNAMIC COEFFICIENTS OF BLUNTED CONES IN A RAREFIED GAS
A. D. Minaichev and R. N. Miroshin 30 Dec. 1971 10 p ref Transl. into ENGLISH from "Aerodinam. Razreshennykh Gazov" (USSR), no. 4, 1969 p 185-189
(AD-739214; FTD-MT-24-1107-71) Avail: NTIS CSCL 20/4

For cones with given spherical blunting and given half flare angle, the dependence of aerodynamic coefficients upon angle of attack alpha obtained in experiment, in a sufficiently broad range of Reynolds and Mach numbers Re and M can be approximated by tabular probability functions. The values of coefficients are examined only as a selection from the totality of random variables with unknown probability characteristics. GRA

N72-27332# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Final Technical Report, Jun. - Sep. 1970
A COMPUTERIZED PROCEDURE TO OBTAIN THE COORDINATES AND SECTION CHARACTERISTICS OF

NACA DESIGNATED AIRFOILS
Don W. Kinsey and Douglas L. Bowers Nov. 1971 79 p refs (AF Proj. 1366)
(AD-738623; AFFDL-TR-71-87) Avail: NTIS CSCL 20/4

The report describes the technical and analytical aspects of a computer program written to give airfoil coordinates, incompressible inviscid section characteristics and two-dimensional drag-rise Mach numbers for a large number of NACA airfoils from a simple one card input. The computer program is a combination of two separate programs. One program gives the airfoil surface coordinates with only the NACA airfoil designation as input, and the other program uses the surface coordinates to predict incompressible, inviscid pressure distribution from which the section characteristics and drag-rise Mach number are determined. The capabilities and accuracies of the computer program are described. GRA

N72-27333# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE RESISTANCE OF PYRAMIDAL BODIES IN THE SUPERSONIC FLOW
V. V. Kravets 30 Dec. 1971 13 p refs Transl. into ENGLISH from Gidroaeromekh. Teor. Uprugosti (Kharkov), no. 9, 1968 p 7-13
(AF Proj. AAH9)
(AD-739293; FTD-HT-23-1247-71) Avail: NTIS CSCL 20/4

Narrow pyramidal shaped bodies whose geometry is determined by angles Delta, Phi, and Pi over Eta are examined. Based on a precise solution corresponding to a flow with a sharp discontinuity at the ribs of two adjacent lobes, a curve in the coordinates of Delta and Phi is plotted which bounds a region of flow with detached shock and attached shocks located between the lobes. The expressions for the pressure coefficient and the friction drag force coefficient make it possible to evaluate the effect of the number of lobes on the nose drag on pyramidal bodies. GRA

N72-27334# Wisconsin Univ., Madison. Dept. of Computer Sciences.
NATURAL CONVECTION IN AN ENCLOSURE WITH LOCALIZED HEATING FROM BELOW
D. Greenspan and D. Schultz Mar. 1972 22 p refs
(PB-208111; WIS-CS-72-148; TR-148) Avail: NTIS HC $3.00 CSCL 20D

If heat is applied at the center of the base of a closed axially symmetric cylinder, a convective flow results in the interior. A numerical method is described for solving the Navier-Stokes equations associated with a mathematical model of this flow type. A variety of problems are described and solved. Author (GRA)

N72-27335# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Hypersonic Research Lab.
SIMILAR SOLUTIONS OF THE THREE DIMENSIONAL BOUNDARY LAYER WITH CONSTANT CROSS FLOW
James W. Christian Nov. 1971 103 p refs
(AF Proj. 7064)
(AD-739864; ARL-71-0252) Avail: NTIS CSCL 20/4

Governing equations are formulated for laminar compressible similar boundary layers with heat transfer, adverse pressure gradient, and constant cross flow. These equations are expressed in finite difference form and solved numerically. Solutions are found for attached and separated flows in adverse pressure gradients for nine combinations of cross flow and heat transfer. The purpose of these solutions is to provide understanding of how cross flow alters the two-dimensional similar results. Solutions are presented in the form of temperature profiles, main flow and cross flow velocity profiles, and global quantities, wall velocity and temperature gradients, displacement thickness, momentum thicknesses, and form factor. GRA

N72-27720*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
QUASI-THREE-DIMENSIONAL CALCULATION OF VELOCITIES IN TURBOMACHINE BLADE ROWS
Theodore Katsanis 1972 20 p refs Proposed for presentation at Winter Ann. meeting of Am. Soc. of Mech. Engr., New York, 12-16 Nov. 1972
(NASA-TM-X-67959; E-6666) Avail: NTIS HC $3.00 CSCL 20D

A practical way of obtaining an approximation to a three dimensional flow is to combine several two dimensional solutions (quasi-three-dimensional solution). Discussed are three basic types of two dimensional solutions (meridional, blade-to-blade, and channel) and several ways of combining them. A centrifugal impeller is analyzed as an example. All recommended methods are based on available general purpose computer programs. Author

N72-27021 National Aerospace Lab., Amsterdam (Netherlands).
EXPERIMENTAL DETERMINATION OF NOZZLE CHARACTERISTICS AND NOZZLE AIRFRAME INTERFERENCE
F. Jaarsma *In* AGARD Airframe/Engine Integration May 1972 45 p refs (For availability see N72-27016 18-02)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N72-27336 National Lending Library for Science and Technology, Boston Spa (England).
THE SIGNIFICANCE OF ATMOSPHERIC ELECTRICITY IN METEOROLOGY
H. Dietz [1972] 102 p refs Transl. into ENGLISH of Meteorologische Abhandl., Band 3, Heft 2 (Berlin), 1970 Freie Univ. Inst. fuer Meteorol. und Geophys. No diagrams, etc.; to be used in conjunction with original book
(NLL-M-22318-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 11 NLL photocopy coupons

The most important facts about atmospheric electric fields, charges, and currents are discussed with emphasis on the connection between atmospheric electricity and meteorology. It is shown that the atmospheric electricity field possesses its own generator in the number of active thunderstorms at one time over the earth. G.G.

N72-27337 National Lending Library for Science and Technology, Boston Spa (England).
SOME CHARACTERISTICS OF WIND WAVES IN THE DEEP AND SHALLOW WATERS OF A BAY
V. A. Rutkovskiy 7 Jan. 1972 15 p refs Transl. into ENGLISH from Okeanologiya (Kiev), V. 11, no. 1, 1971 p 35-43
(NLL-Trans-2508-(3623.66)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The results are presented for measurements of wind wave elements and wave pressure caused by them at subsurface levels of deep and shallow bay waters. The experimental distribution of wave heights and periods is compared with a generalized distribution function. The transformation of the wind wave spectrum with depth and in the transition of waves from deep to shallow water was analyzed. Author

N72-27338 National Lending Library for Science and Technology, Boston Spa (England).
ON THE STRUCTURE OF THE SEA SURFACE TEMPERATURE FIELD
V. N. Ivanov, A. S. Monin, and V. T. Paka [1972] 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), no. 183, 1968 p 1304-1307
(NLL-M-22342-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The results of sea surface temperature recordings are presented for the Atlantic and Mediterranean from Dec. 1966 to

Jan. 1967. A statistical and mathematical analysis of the structure functions for the temperature field is given. K.P.D.

N72-27339 Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
RECORD OF OBSERVATIONS AT RESOLUTE BAY MAGNETIC OBSERVATORY, 1969, VOLUME 43, NO. 5
G. Jansen VanBeek and H. R. Reny 1972 77 p refs
(M70-43/5) Copyright. Avail: Issuing Activity

Tables of magnetic observations are presented for Resolute, Cornwallis Island, Northwest Territories. The magnetic equipment is described. K.P.D.

N72-27340 National Lending Library for Science and Technology, Boston Spa (England).
PREPARATION OF HYDROLOGICAL OBSERVATIONS FOR PAST YEARS FOR USE ON COMPUTERS
A. M. Komlev and I. Ja. Liser [1972] 7 p refs Transl. into ENGLISH from Proc. of Symp. on Exchange of Practical Experience in the Computerization of Hydrol. Data, 23-27 Jun. 1970 (Moscow), 1971 p 61-64
(NLL-M-22333-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The use of computers for hydrological research and calculations is considered. Emphasis is placed on the problem of storage and punched card input. Author

N72-27341 National Lending Library for Science and Technology, Boston Spa (England).
AUTOMATION OF THE WORKING UP OF HYDROLOGICAL OBSERVATIONS
N. K. Kljukin [1972] 6 p refs Transl. into ENGLISH from Proc. of Symp. on Exchange of Practical Experience in the Computerization of Hydrol. Data, 23-27 Jun. 1970 (Moscow), 1971 p 5-9
(NLL-M-22344-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A flow diagram for automated data processing for hydrological research is presented. The rationale for its development is considered. K.P.D.

N72-27342 National Lending Library for Science and Technology, Boston Spa (England).
AUTOMATIC PROCESSING OF OPERATIONAL HYDROLOGICAL INFORMATION
E. P. Chemerenko and K. M. Sikanova [1972] 12 p Transl. into ENGLISH from Proc. of Symp. on Exchange of Practical Experience in the Computerization of Hydrol. Data, 23-27 Jun. 1970 (Moscow), 1971 p 65-75
(NLL-M-22339-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The development of computer codes and processing algorithms for the retrieval and analyses of routine hydrological information arriving in the form of messages or group of messages is reported. One code provides information about water levels, water temperatures, ice phenomena and thickness, elements of waviness on lakes and reservoirs, measured and calculated discharges, extreme levels, data on the upper reach of hydro-electric power stations, and data on the components of the water balance in a 10-day period for different water basements. The other code treats results of snow surveys on flat land and in mountains. G.G.

N72-27343 National Lending Library for Science and Technology, Boston Spa (England).
METHODS FOR THE AUTOMATIC CONTROL AND PROCESSING OF THE RESULTS OF GAUGE OBSERVATIONS
V. I. Grigorev and G. V. Lesnikova [1972] 15 p refs Transl. into ENGLISH from Proc. of the Symp. Exchange of Practical Experience in the Computerization of Hydrological Data (Moscow), 1971 p 36-47 No diagrams, etc.; to be used in conjunction with original paper
(NLL-M-22341-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Computerized processing of hydrological data from gauge measurements is discussed. Data on water level, water temperature, ice phenomena, thickness of ice, presence or absence of vegatation, air temperature and precipitation are entered on punched tape for further processing and retrieval. G.G.

N72-27344 National Lending Library for Science and Technology, Boston Spa (England).
STUDIES ON THE WATER AND HEAT BALANCE OF SLOPES
F. Ficula [1972] 10 p refs Transl. into ENGLISH from Wiss. Z. Karl-Marx-Univ., Leipzig, Math.-Naturwiss. Reihe (East Germany), v. 13, 1964 p 783-788 No diagrams etc.; to be used in conjunction with original book
(NLL-M-22458-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Humidity and heat conditions are studied on north and south slopes of a valley by measuring soil moisture, precipitation and runoff in the vegetation periods of 1957 to 1961. Terrain profiles show that soil moisture is lower on the south slope and that water content differences are greatest in the top layers of soil. Water balance equations develop an eight percent higher evaporation on the south slope. Heat balance studies show that the shorter the day the greater the radiation balance between the south and north slopes. It is concluded that the exposure of the slope should be allowed for in calculating water requirements of plants in hilly regions and that slope use and melioration systems should suit slope direction. G.G.

N72-27345*# Illinois Univ., Urbana.
A VERY HIGH FREQUENCY RADIO INTERFEROMETER FOR INVESTIGATING IONOSPHERIC DISTURBANCES USING GEOSTATIONARY SATELLITES. DETERMINATION OF CHANGES IN EXOSPHERIC ELECTRON CONTENT BY A COMPARISON OF GROUP DELAY AND FARADAY ROTATION
Robert Terry, Bernard J. Flaherty, and Richard E. DuBroff Mar. 1972 119 p refs
(Grant NGR-14-005-002)
(NASA-CR-127270; UILU-ENG-72-2539; TR-45-1; TR-45-2) Avail: NTIS HC $8.00 CSCL 04A

The theory and development of a VHF correlation radio interferometer for investigating ionospheric disturbances are discussed. The system was developed to receive signals from the geostationary Applications Technology Satellites. Amplitude and phase variations of the signal passing through the ionosphere can be detected by this instrument. The system consists of two superheterodyne receivers separated by a distance known as the baseline of the system. Since the system is a phase sensitive instrument, the local oscillators of the two receivers must be phase coherent. This is accomplished by using phase-locked loops for generating the local oscillators. The two signals from the separate receivers are cross-correlated by multiplying the two signals together and then time averaging the result. The sensitivity of the instrument is increased by off-setting one of the local oscillators by a small amount. Author

N72-27346*# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
OBSERVATIONS OF INTERCHANGE BETWEEN ACCELERATION AND THERMALIZATION PROCESSES IN AURORAL ELECTRONS Ph.D. Thesis
Morris B. Pongratz Jun. 1972 275 p refs
(Contract NSR-21-002-077; Grant NGL-21-002-008)
(NASA-CR-127522; TN-BN-737) Avail: NTIS HC $15.75 CSCL 03B

The results of high time-resolution measurements of energetic electrons in an auroral break up are presented. Electrons with

energies from 500 eV to over 100 keV and pitch angles from 0 to 150 deg were detected with two detectors onboard sounding rocket 18:63 UE. Complete energy spectra were taken every 0.1 seconds. The procedure for cleaning and activating the BeCu dynodes of a small, rugged, high gain electron multiplier is described. A theoretical study of the energy-angular response of a spherical plate electrostatic analyzer is compared to experimental results. An energy spectrum unfolding technique which does not require the assumption of a histogram-type energy spectrum is presented. A method of determining sounding rocket orientation from the output of a single magnetometer is described. Author

N72-27347*# California Univ., Los Angeles. Dept. of Physics.
ELECTROSTATIC INSTABILITY OF RING CURRENT PROTONS BEYOND THE PLASMAPAUSE DURING INJECTION EVENTS
F. V. Coroniti, R. W. Fredericks, and Roscoe B. White May 1972 17 p refs Prepared in cooperation with TRW Systems Group, Redondo Beach, Calif.
(Contract NASw-2357; Grants NGR-05-007-190; NGR-05-07-116; Contracts N00014-69-A-0200-4023; AT(04-3)-34; Grant NSF GP-22817; Proj. 157)
(NASA CR-122447; PPG-119) Avail: NTIS HC $3.00 CSCL 03B

The stability of ring current protons with an injection spectrum modeled by an m = 2 mirror distribution function was examined for typical ring current parameters. It was found that the high frequency loss cone mode can be excited at wave numbers K lambda sub Di about = to 0.1 to 0.5, at frequencies omega about = to (0.2 to 0.6) omega sub pi and with growth rates up to gamma/omega about = to 0.03. These waves interact with the main body of the proton distribution and propagate nearly perpendicular to the local magnetic field. Cold particle partial densities tend to reduce the growth rate so that the waves are quenched at or near to the plasmapause boundary. Wave e-folding lengths are comparable to 0.1 R sub e, compared to the value of about 4 R sub e found for ion cyclotron waves at the same plasma conditions. Author

N72-27348# Intermountain Field Operation Center, Denver, Colo.
SATELLITE MONITORING OF OPEN PIT MINING OPERATIONS
William C. Henkes 1971 31 p
(BM-IC-8530) Avail: SOD $0.35

Anticipating the availability of space altitude imagery from the earth resource technology satellites, the Bureau of Mines investigated the possibilities of using such imagery in its activities in solid waste disposal, reclamation of mine workings, and mineral resource inventory. The study indicates that monitoring open pit and strip mining operations can be done using conventional techniques if the sharpness of the imagery is sufficiently high. Possibilities also exist for semiautomated processes for change detection. Author

N72-27349*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
INTERPOLATION CONSTANTS FOR CALCULATION OF TRANSMITTANCE AND RATE OF DISSOCIATION OF MOLECULAR OXYGEN IN THE MESOSPHERE AND LOWER THERMOSPHERE
Robert D. Hudson and Stephen H. Mahle Jan. 1972 26 p refs
(NASA-TM-X-58084; MSC-05801) Avail: NTIS HC $3.50 CSCL 04A

Values of band oscillator strengths and rotational line widths for the Schumann-Runge band system have been used to derive interpolation constants from which the transmittance and rate of dissociation of molecular oxygen can be calculated. These constants, valid for temperatures between 150 and 300 K and for column densities between 1 x 10 to the 17th power/cm sq and 7 x 10 to the 24th power/cm sq, cover the wavelength range 1750 and 2050A. Author

N72-27350*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
OBSERVED RELATIONSHIPS BETWEEN ELECTRIC FIELDS AND AURORAL PARTICLE PRECIPITATION
D. A. Gurnett and L. A. Frank Apr. 1972 79 p refs
(Contracts NAS5-10625; NAS1-8141; NAS1-8141; Grant NGL16-001-002; Contract N00014-68-A-0196-0003)
(NASA-CR-127254; U-of-Iowa-72-8) Avail: NTIS HC $6.00 CSCL 03B

Simultaneous electric field and plasma observations with the low altitude, polar orbiting satellite Injun (Hawkeye) 5 provided a comprehensive survey of convection electric fields and their association with magnetospheric plasma phenomena. The most prominent features of the convection electric fields are reversals located at high magnetic latitudes, with generally anti sunward convection poleward convection equatorward of the electric field reversal location. The electric field reversal is interpreted as the boundary between open and closed magnetic field lines. To investigate the electric field and plasma interrelationships during a polar magnetic substorm, a series of passes obtained prior to and during a substrom is presented. Large, anti sunward convection velocities were detected over the polar cap several tens of minutes before the onset of the expansive phase of the substrom. These convection velocities gradually decreased during the decay phase of the substrom. Measurements of enhanced anti sunward flow over the polar cap region are generally consistent with concepts of the origin of substroms. Author

N72-27351*# Geological Survey, Washington, D.C.
FEASIBILITY OF SURVEYING PESTICIDE COVERAGE WITH AIRBORNE FLUOROMETER
George E. Stoertz and William R. Hemphill Apr. 1970 24 p refs
(NASA Order T-90485C)
(NASA-CR-127528; USGS-IR-NASA-184) Avail: NTIS HC $3.25 CSCL 02D

Response of a Fraunhofer line discriminator (FLD) to varying distributions of granulated corncobs stained with varying concentrations of Rhodamine WT dye was tested on the ground and from an H-19 helicopter. The granules are used as a vehicle for airborne emplacement of poison to control fire ants in the eastern and southeastern United States. Test results showed that the granules are detectable by FLD but that the concentration must be too great to be practical with the present apparatus. Possible methods for enhancement of response may include: (1) increasing dye concentration; (2) incorporating with the poisoned granules a second material to carry the dye alone; (3) use of a more strongly fluorescent substance (at 5890 A); (4) modifying the time interval after dyeing, or modifying the method of dyeing; (5) modifying the FLD for greater efficiency, increased field of view or larger optics; or (6) experimenting with laser-stimulated fluorescence. Author

N72-27352*# Geological Survey, Denver, Colo.
GEOLOGIC STUDIES OF YELLOWSTONE NATIONAL PARK IMAGERY USING AN ELECTRONIC IMAGE ENHANCEMENT SYSTEM
Harry W. Smedes May 1970 31 p refs Original contains color illustrations
(NASA Order R-09-020-015)
(NASA-CR-127531; USGS-IR-NASA-181) Avail: NTIS HC $3.75 CSCL 08G

The image enhancement system is described, as well as the kinds of enhancement attained. Results were obtained from various kinds of remote sensing imagery (mainly black and white multiband, color, color infrared, thermal infrared, and side-looking K-band radar) of parts of Yellowstone National Park. Possible additional fields of application of these techniques are considered. Author

N72-27353*# Geological Survey, Washington, D.C.
TEST OF AIRBORNE FLUOROMETER OVER LAND SURFACES AND GEOLOGIC MATERIALS

George E. Stoertz and William R. Hemphill May 1970 45 p refs
(NASA Order T-80485C)
(NASA-CR-127529; USGS-IR-NASA-185) Avail: NTIS HC $4.25 CSCL 08G

Response of an experimental Fraunhofer line discriminator to a wide range of surficial deposits common in deserts and semideserts was tested in the laboratory and from an H-19 helicopter. No signals attributable to fluorescence were recorded during 540 miles of aerial traverses over southeastern California and west-central Arizona. It was concluded that exposed surfaces of target materials throughout the traverses were either nonluminescent at 5890 A or not sufficiently so to be detectable. It cannot be ruled out that the lack of fluorescence is partly attributable to surficial coatings of nonluminescent weathered material. The principal route surveyed from the air was from Needles, California to Furnace Creek Ranch, Death Valley and return, via the Amargosa River valley, Silurian Lake (dry), Silver Lake (dry), and Soda Lake (dry). Principal targets traversed were unconsolidated clastic sediments ranging from silty clay to cobbles, and a wide range of evaporite deposits.
Author

N72-27354*# Techtran Corp., Glen Burnie, Md.
EXPERIMENTS ON A PROGRAM OF WORLD MAGNETIC SURVEY
Sh. Dolginov, V. I. Nalivayko, A. V. Tyurmin, and M. N. Chinchevoy Washington NASA Mar. 1972 15 p refs Transl. into ENGLISH from "Issledovaniya Kosmicheskogo Prostranstva" Moscow, Nauka Press, 1965 p 606-614
(Contract NASw-2037)
(NASA-TT-F-14407) Avail: NTIS HC $3.00 CSCL 08N

The desirability of having more accurate maps of the distribution and intensity of the earth's magnetic field is indicated. Use of proton magnetometers is stated to be the method of choice for determining the magnetic field at any point, preferably from relatively low-flying satellites in substantially circular orbits. The mode of operation of such magnetometers is described briefly. Their operation in a satellite to yield data which can be either transmitted to an earth station or memorized is discussed. Evidence is given to show that spurious signals resulting from unfavorable orientation or deceptive signal to noise ratio can be identified and rejected. Anticipated future benefits to be attained by a systematic world survey of the magnetic field are indicated.
Author

N72-27355*# National Aeronautics and Space Administration, Washington, D.C.
INVESTIGATION OF ELECTRON SPECTRA IN THE EARTH'S INNER RADIATION BELT BY THE SATELLITE KOSMOS 219
O. I. Savun and P. I. Shavrin Apr. 1972 11 p refs Transl. into ENGLISH from Kosmich. Issled (Moscow), v. 9, no. 6, 1971 p 890-895
(NASA-TT-F-14405) Avail: NTIS HC $3.00 CSCL 03B

Measurements of electron spectra made in April 1968, and a comparison with the 1962 to 1966 experiments trace the change in the shape of electron spectra in the inner belt. A 1968 separation of the electron spectrum into two components was observed: soft and hard. Integral and differential spectra of electron with E = 0.12 to 15 MeV on L = 1.2 to 1.8, and the spatial distribution of the electrons in the inner belt, are cited.
Author

N72-27356*# Geological Survey, Washington, D.C.
RECOGNITION ON SPACE PHOTOGRAPHS OF STRUCTURAL ELEMENTS OF BAJA CALIFORNIA
Warren Hamilton 1971 28 p refs Sponsored in part by NASA
(NASA-CR-127259; LC-74-181492; USGS-PP-NASA-718) Avail: NTIS; SOD $0.45 CSCL 08E

Photographs of Baja California taken from space--by astronauts using hand-held cameras on various Gemini and Apollo missions and by automatic camera on the Apollo 6 flight--provide illustrations of known structural features of the peninsula and also reveal some structures not recognized previously. An apparent transform relationship between strike-slip and normal faulting is illustrated by the overlapping vertical photographs from Apollo 6 of northern Baja California. The uplands of the high Sierra San Pedro Martir are seen on the photographs to be a low-relief surface deformed by young faults, monoclines, and warps, which mostly produce west-facing steps and slopes. The topography is basically structural, not erosional.
Author

N72-27357*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
WORLD MAPS OF PREDICTED ELECTRON INTENSITIES FOR THE ITOS-A/NOAA-1 SPACECRAFT
E. G. Stassinopoulos Jun. 1972 14 p refs
(NASA-TM-X-65917; x-601-72-195) Avail: NTIS HC $3.00 CSCL 03B

Maps of electron fluxes > 10,000, > 1 million, and > 10 million particles/sq cm/sec are presented for an ITOS-A/NOAA-1 circular orbit, inclination of 79 deg, and altitude of 1463 km. The uncertainty in the flux values is about a factor of 3, and the error in contour plotting may be plus or minus 2 deg in latitude and plus or minus 3 deg in longitude. The fractional lifetime spent within the different intensity regions is graphed.
N.E.N.

N72-27358*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CONSERVATION LAWS AND PREFERRED FRAMES IN RELATIVISTIC GRAVITY
Clifford M. Will and Kenneth Nordtvedt, Jr. (Montana State Univ., Bozeman) May 1972 79 p refs
(Contract NAS7-100; Grants NGR-05-002-256; NGR-27-001-035; NSF GP-27304; NSF GP-28027)
(NASA-CR-127277; OAP-284) Avail: NTIS HC $6.00 CSCL 08N

The parameterized post-Newtonian formalism and preferred-frame theories of gravity are examined in detail. For individual titles, see N72-27359 through N72-27360.

N72-27359* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PREFERRED FRAME THEORIES AND AN EXTENDED PPN FORMALISM
In its Conserv. Laws and Preferred Frames in Relativistic Gravity May 1972 39 p refs (For availability see N72-27358 18-13) CSCL 08N

The parameterized post-Newtonian (PPN) formalism, which treats the post-Newtonian limits of metric theories of gravity in terms of a series of metric parameters whose values vary from theory to theory, is considered. A revised and somewhat extended version of the PPN formalism is proposed. In the proposed version the metric parameters are regrouped so that they are individually related to different physical or conceptual aspects of metric theories. With the new parameters, classification of metric theories of gravity can be categorized by four attributes: (1) curvature of space-geometry, (2) nonlinearity of gravity, (3) preferred universal rest-frame, and (4) conservation laws for energy-momentum.
D.L.G.

N72-27360* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EXPERIMENTAL EVIDENCE TO RULE OUT PREFERRED FRAME THEORIES OF GRAVITY
In its Conserv. Laws and Preferred Frames in Relativistic Gravity May 1972 39 p refs (For availability see N72-27358 18-13) CSCL 08N

Preferred-frame theories, metric theories which single out the frame which moves with the universe's smoothed-out distribution of matter as a preferred-frame, are considered. It is pointed out that while these theories have until recently been considered to be viable alternatives to general relativity, a close

examination reveals that these theoretical predictions agree with observations only if the solar system is assumed to be at rest relative to the preferred universal rest-frame. It is felt that a more reasonable assumption would be that the solar system moves through the universe with a velocity of around 200 km/sec. Evidence is then presented to show that such a 200 km/sec. motion produces, according to preferred-frame theories of gravity, observable solar-system effects which are in disagreement with observation. D.L.G.

N72-27361*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
EMPIRICAL DATA AND THE VARIANCE-COVARIANCE MATRIX FOR THE 1969 SMITHSONIAN STANDARD EARTH (2)
E. M. Gaposchkin 17 Apr. 1972 66 p refs
(Grant NGR-09-015-002)
(NASA-CR-127269; SAO-Special-Rept-342; Rept-202-105) Avail: NTIS HC $5.50 CSCL 08N

The empirical data used in the 1969 Smithsonian Standard Earth (2) are presented. The variance-covariance matrix, or the normal equations, used for correlation analysis, are considered. The format and contents of the matrix, available on magnetic tape, are described and a sample printout is given. Author

N72-27362# National Oceanic and Atmospheric Administration, Washington, D.C.
SOME PRELIMINARY RESULTS OF 1971 AIRCRAFT MICROWAVE MEASUREMENTS OF ICE IN THE BEAUFORT SEA
Richard J. DeRycke and Alan E. Strong Jun. 1972 11 p refs
(NOAA-TM-NESS-37) Avail: NTIS HC $3.00

Passive microwave data in the 2.8-cm (10.69 GHz) wavelength region were acquired from a NASA aircraft during the 1971 Arctic ice dynamics joint experiment. Comparison of data obtained on a cloud-free day and on a day with a complete cloud cover beneath the aircraft demonstrated that the relative age of sea ice may be observed and manned adequately by microwave sensing from satellite altitudes regardless of cloud cover. Author

N72-27363*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE SIGNIFICANCE OF THE REDSHIFT ROCKET PROBE EXPERIMENT TO THE THEORIES OF GRAVITATION
R. F. C. Vessot 1 May 1972 19 p refs
(Contract NAS8-27969)
(NASA-CR-127429; SAO-Special-Rept-343) Avail: NTIS HC $3.00 CSCL 08N

Direct measurements of the effects of gravitation on time are discussed. Using the earth's gravity these measurements can now be made to 20 parts per million. At present, there is a 1% verification of the equivalence principle for clocks made over a 75-ft vertical distance by use of Mossbauer gamma ray emission and absorption. Measurements made to greater accuracy and spanning distances where appreciable curvature of the metric of spacetime will help verify the equivalence principle, a postulate upon which Einstein developed his General Theory of Relativity. Author

N72-27364*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE DIURNAL HEAT BUDGET OF THE THERMOSPHERE
S. Chandra and A. K. Sinha (Md. Univ., College Park) May 1972 29 p refs Submitted for publication
(Contract NSR-21-002-096)
(NASA-TM-X-65928; X-621-72-185) Avail: NTIS HC $3.50 CSCL 04A

Detailed numerical calculations of thermospheric heat sources and sinks are presented and their relative importance is discussed in reference to the energy balance phenomena of the neutral atmosphere. It is shown that the thermal energy available from the absorption in the Schumann-Runge continuum leading to photodissociation of O2 is by far the largest energy source in the lower thermosphere. Other sources of varying importance in different altitude ranges are: (1) energy from photoelectrons, (2) energy exchange from thermal plasma, (3) chemical reactions (ion-electron dissociative recombination) energy gain, and (4) kinetic and dissipative energy associated with the neutral wind. The energy sinks of importance are thermal conduction at the lower boundary (120 km) and radiative cooling of atomic oxygen. It is shown that the combined energy from processes 2 to 4 constitute only a small fraction of the total energy available from photoelectrons and are in phase with the latter. It is suggested that a choice of a lower boundary much below 120 km, e.g. near the mesopause level (90 km), should be more appropriate for general thermospheric studies. Author

N72-27365*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POLAR CAP ELECTRIC FIELD DISTRIBUTIONS RELATED TO THE INTERPLANETARY MAGNETIC FIELD DIRECTION
J. P. Heppner Jun. 1972 20 p refs Submitted for publication
(NASA-TM-X-65934; X-645-72-216) Avail: NTIS HC $3.25 CSCL 08N

The correlations between the azimuthal direction of the interplanetary magnetic field and the most simple polar cap signatures are discussed. Only the spatial distribution of the dawn-dusk polar cap field is considered. For each OGO 6 traverse across the northern or southern polar cap, the simultaneous values of the interplanetary magnetic field in solar-equatorial coordinates were recorded by the Explorer 33 magnetometer. Histograms of these values are presented and are discussed. The high degree of correlation with the longitudinal angle indicates that the relative geometry of the interplanetary magnetic field and magnetospheric magnetic fields must be fundamental to explaining the distribution of polar cap electric fields. The sign of the solar-equatorial component perpendicular to the sun-earth line appears to be a more critical parameter than the sign of the component toward the sun. The Svalgaard-Mansurov correlation and the correspondence between fast convection and parallel magnetospheric and interplanetary magnetic fields are described. N.E.N.

N72-27366# Geological Survey, Washington, D.C.
CHEMISTRY OF KILAUEA AND MAUNA LOA LAVA IN SPACE AND TIME
Thomas L. Wright 1971 45 p refs
(USGS-PP-735) Avail: SOD $0.50

Kilauea and Mauna Loa, Hawaii's two active shield volcanoes, are composed of tholeiitic basalt having MgO contents ranging from more than 20 percent to less than 4 percent. The chemical variability of Mauna Loa and Kilauea lava having more than about 6.8 percent MgO is principally explained by addition or removal of olivine (olivine control). The chemical variability of these lavas is described and interpreted. Lavas having less than 6.8 percent MgO are fractionated by separation of pyroxene, plagioclase, and Fe-Ti oxides in addition to olivine. A model is proposed for the origin of Kilauea which embodies the following points: (1) generation by partial melting of picritic magmas (20 to 25 percent MgO) at depths of greater than 60 kilometers, (2) high pressure fractionation of these magmas during relatively slow ascent to a storage region at 20 to 30 km depth, (3) minor fractionation during storage followed by rapid ascent into shallow crustal reservoirs at 2 to 4 km depth, and (4) settling of olivine during storage at 2 to 4 km and periodic eruption of the upper parts of these reservoirs, or rarely, the entire reservoir including settled olivine. Author

N72-27367# Rhodesia Univ., Salisbury. Inst. of Mining Research.
[PURE AND APPLIED RESEARCH IN GEOLOGY AND EXTRACTIVE METALLURGY]
K. A. Viewing Jan. 1972 71 p
(Rept-9; AR-3) Avail: NTIS HC $5.75

The research investigations in progress cover a wide field of economic potential in geology and in extractive metallurgy. The report covers the second full year of operation of the Institute and during this period significant progress was made in several activities. The results are reported and the research program for the coming year is described. Author

N72-27368# South Dakota State Univ., Brookings. Remote Sensing Institute.
REMOTE SENSING FOR EVALUATING FLOOD DAMAGE CONDITIONS. THE RAPID CITY, SOUTH DAKOTA FLOOD, 9 JUNE 1972, FIELD INVESTIGATION REPORT A report to the Governor of South Dakota
Victor I. Myers, Fred A. Waltz, and Jack R. Smith Jun. 1972 32 p
(SDSU-RSI-72-11) Avail: NTIS HC $3.75

Flood-damaged areas in the vicinity of Rapid City, South Dakota were surveyed at 4000 ft above ground level with Ektachrome color and Ektachrome color infrared film (70 mm width), and with thermal infrared. The photos have 60% overlap for stereo viewing. The areas covered included: (1) Rapid Creek, from the headwaters to the Cheyenne River, approximately 70 miles; (2) Box Elder Creek, from 10 miles above Interstate 90 north of Rapid City, downstream to New Underwood, approximately 30 miles; (3) Keystone and downstream, approximately 5 miles; (4) Hill City and vicinity; and (5) the area along the Burlington and Quincy Railroad between Keystone and Hill City, approximately 10 miles. Author

N72-27369*# Illinois Univ., Urbana. Dept. of Electrical Engineering.
ATLAS OF ELECTRON CONTENT VALUES OBSERVED AT URBANA, ILLINOIS, 1 DECEMBER 1967 - 30 DECEMBER 1970
Bernard J. Flaherty and Rao N. Narayana Jun. 1972 181 p
(Grant NGR-14-005-002)
(NASA-CR-127524; TR-47; UILU-ENG-72-2540) Avail: NTIS HC $11.25 CSCL 04A

Ionospheric electron content versus local time data deduced from Faraday rotation observations of ATS-III geostationary satellite signals at Urbana, Illinois are reported. The data are presented in two forms. Values of subionospheric latitude (SILAT) and subionospheric longitude (SILON) are in degrees north and degrees west, respectively. These are computed on the basis of 350 km for the mean ionospheric height, which value is also used for the calculation of the geometric-magnetic factor, required for the conversion of the measured Faraday rotation angle to electron content. Entries of zero for the electron content in the tables represent no data for those times. Author

N72-27370*# Stanford Univ., Calif. Inst. for Plasma Research.
ANNUAL AND SOLAR-MAGNETIC-CYCLE VARIATIONS IN THE INTERPLANETARY MAGNETIC FIELD, 1926-1971 Interim Scientific Report
John M. Wilcox and Philip H. Scherrer Apr. 1972 20 p refs
(Grant NGR-05-020-559; Contract N00014-67-A-0112-0068; Grant NSF GA-31138; NR Proj. 323-003)
(NASA-CR-127422; SU-IPR-466) Avail: NTIS HC $3.00 CSCL 08N

The analysis of forty-five years of inferred interplanetary magnetic field polarity shows an annual variation and a variation of about twenty years, associated here with the solar magnetic cycle. On the average the phase of the annual variation of the interplanetary field changes about 2 and 2/3 years after sunspot maximum, i.e. for about ten consecutive years the predominant polarity of the interplanetary field is away from the sun during the six-month interval in which the earth is at southern heliographic latitudes. Then a change of phase occurs so that for about the next ten years the predominant polarity is toward the sun, while the earth is at southern heliographic latitudes. The annual variation changes its predominant polarity within a few days of the times when the heliographic latitude of the earth is zero. Author

N72-27371# Institut d'Aeronomie Spatiale de Belgique, Brussels.
THE EFFECT OF PHOTOELECTRONS ON KINETIC POLAR WIND MODELS
J. Lemaire and M. Scherer 1972 18 p refs
(A-N99-1972) Avail: NTIS HC $3.00

The influence of photoelectrons in the polar ion-exosphere is discussed using a kinetic model calculation. The escape flux, the bulk velocity, and the parallel and perpendicular temperatures of the thermal electrons depend strongly on the value of the photoelectron flux; the number density distributions remain unchanged. Although the photoelectrons remain a minor constituent, they carry almost the total energy flux of the negatively charged particles. Author

N72-27372# Institut d'Aeronomie Spatiale de Belgique, Brussels.
PORTUGAL OBSERVATIONS OF LUMINOUS PHENOMENA IN RELATION TO BARIUM RELEASE IN THE MAGNETOSPHERE [OBSERVATIONS AU PORTUGAL DE PHENOMENES LUMINEUX SE RAPPORTANT A UNE EXPERIENCE DE LACHER DE BARIUM DANS LA MAGNETOSPHERE]
E. VanHemelrijck and H. Debehogne 1972 11 p In FRENCH; ENGLISH summary
(Aeronomica-Acta-A-102) Avail: NTIS HC $3.00

Ground based observations made in Coimbra (Portugal) of luminous phenomena related to the barium ion cloud are described. Precise sky coordinates are given as well as the dimension of the cloud versus time and its apparent motion. Author

N72-27373# National Physical Lab., New Delhi (India). Radio Science Div.
IONOSPHERIC DATA, SEPTEMBER 1970
Sep. 1970 80 p
(RTRC-A184) Avail: NTIS HC $6.00

Tables of hourly values of propagation data for the E and F regions are presented for several stations in India. These include critical frequency, minimum virtual height, F-min, and M(3000)F2 data. Author

N72-27374# National Physical Lab., New Delhi (India). Radio Science Div.
IONOSPHERIC DATA, AUGUST 1970
Aug. 1970 80 p
(RTRC-A183) Avail: NTIS HC $6.00

Tables of hourly values of propagation data for the E and F regions are presented for several stations in India. These include critical frequency, minimum virtual height, F-min, and M(3000)F2 data. Author

N72-27375*# Michigan Univ., Ann Arbor. School of Natural Resources.
REMOTE SENSING OF CHANGES IN MORPHOLOGY AND PHYSIOLOGY OF TREES UNDER STRESS Annual Progress Report No. 4
Charles E. Olson, Jr., Wayne G. Rohde, and Jennifer M. Ward Berkeley, Calif. Calif. Univ. Forestry Remote Sensing Lab. 30 Sep. 1970 32 p refs Prepared for Calif. Univ., Berkeley. Forestry Remote Sensing Lab. in cooperation with Dept. of Agr. Forest Serv.
(NASA Order W-12996)
(NASA-CR-127420) Avail: NTIS HC $3.75 CSCL 02F

Results of continuing studies of forest trees subjected to varying types of stress are reported. Both greenhouse and field studies are included. Greenhouse work with tree seedlings exposed to varying levels of NaCl and CaCl2 in the soil indicated that, in the initial stages, palisade cells shrink and the amount of air space in the leaf increases. As the severity of damage increases, the cells of the spongy mesophyll shrink and flatten, and the amount of air space in the leaf decreases. Statistical analysis of foliar reflectance and associated moisture content data led to a series of regression equations for predicting foliar moisture content from reflectance data. Equations were calculated

for three species, yellow birch (Betula alleghaniensis Britton), sugar maple (Acer saccharum Marsh.) and white ash (Fraxinus americana L.) having multiple correlation coefficients of 0.98, 0.94 and 0.93 respectively. Interpretation of multispectral imagery of the Ann Arbor Forestry Test Site (NASA Site 190) provided evidence that infections of Fomes annosus can be detected in the early stages. Infections of two needle cast diseases were also detected in conifer plantations in the test site. A study of automatic interpretation of multispectral scanner imagery for tree species recognition provided encouraging results. Author

N72-27376*# Denver Univ., Colo. Dept. of Physics.
SUDDEN IMPULSES IN THE GEOMAGNETOTAIL AND THE VICINITY
V. L. Patel [1971] 29 p refs Presented at the 15th Gen. Assembly, IUGG, Moscow, Aug. 1971
(Grants NGR-06-004-058; NGR-24-005-180; NSF GA-10999)
(NASA-CR-127421) Avail: NTIS HC $3.50 CSCL 04A

Explorer 33 magnetic field observations were analyzed to study the propagation of sudden impulses (SI) in the geomagnetic tail and the magnetosheath. Average speed of propagation in these regions is 760 km per sec with a range of 550 to 1230 km per sec. Most of the SI's have propagation speed close to that of the shock wave observed in this region. Positive SI is shown to have a positive change in the tail or magnetosheath and a negative SI has a similar negative change. Nine out of thirteen correlated SI's have their origin in the solar wind continuities, while four SI's possibly originate in the perturbations of the tail or magnetosheath field. It was found that the SI propagation is not confined to the tail region but has correlated effects in the magnetosheath. The propagation region studied was in 2000 to 0200 local time sector. Author

N72-27377# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATION OF THE MOTION OF ARTIFICIAL IONIZED CLOUDS IN THE UPPER IONOSPHERE
L. A. Katasev and V. F. Chepura [1972] 4 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 12, no. 3, 1972 p 473-476
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Results are presented for simultaneous observations of the motion of artificial ionized and luminous clouds in the ionosphere. The velocity of the ionized clouds was measured using the Doppler frequency shift; the luminous clouds were photographed. The results show that phase changes in radio waves during reflection from the ionized clouds are controlled mainly by cloud motion, and not by space-time instability in its configuration. Author

N72-27378# Lockheed Missiles and Space Co., Palo Alto, Calif.
HEAT INFLUX TO AN ELECTRON GAS AT h > 180 km ALTITUDES
G. L. Gdalevich [1972] 7 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 12, no. 2, 1972 p 266-272
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Experimental results on electron and neutral particle concentrations and temperatures obtained from rocket sounding were used to compute the heat influx to an electron gas. It is shown that cooling of the electron gas due to excitation of the fine structure of the atomic oxygen electron levels plays an essential role in, and permits explanation of, the fundamental peculiarities in the electron temperature profile in relation to electron and neutral concentration profiles. Author

N72-27379# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATION OF THE INFLUENCE OF REGULAR HORIZONTAL GRADIENTS AND LOCAL AND INTEGRATED ELECTRON CONCENTRATIONS IN THE IONOSPHERE ON THE MAGNITUDE AND CHARACTER OF THE CHANGE IN THE REDUCED DIFFERENCE IN THE DOPPLER FREQUENCY SHIFT ALONG AN ARTIFICIAL EARTH SATELLITE ORBIT
D. S. Lukin and V. A. Shkolnikov [1972] 8 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 10, no. 1, 1972 p 66-72
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Results of a numerical computation of Doppler frequency variations due to the influence of the earth's ionosphere are considered for several satellite orbits for a spherically laminar and horizontally inhomogeneous ionosphere. The influence of regular horizontal gradients in N and of local and integrated electron concentrations on the magnitude and character of variations was investigated. The contribution of terms dependent on each component to the total variations was extracted. It is shown that the strongest influence on the quasi-periodic variation along an orbit is exerted by regular horizontal gradients in the electron concentration on the entire path of radio wave propagation. Author

N72-27380# Genoa Univ. (Italy).
GENOVA-MONTE CAPELLINO OBSERVATORY: IONOSPHERIC DATA, JANUARY - DECEMBER 1971
1972 64 p Sponsored in part by CNR
Avail: NTIS HC $5.25

Tables of ionospheric data derived from observations made at Genoa-Monte Capellino Observatory, Italy, from January to December 1971 are presented. Both vertical sounding and vertical incidence absorption measurements were made. ESRO

N72-27381# European Space Research Organization, Paris (France).
EUROPE AND REMOTE SENSING: CRITICAL CONSIDERATIONS AND FUTURE PERSPECTIVES [L'EUROPE ET LA TELEDETECTION: REFLEXIONS CRITIQUES ET PERSPECTIVES D'AVENIR]
R. Tessier and J. Plevin Rome Mar. 1972 12 p In FRENCH Presented at the 19th Rass. Intern. Elettronica, Nucl. ed Aerospaziale, Rome, Mar. 1972
(SI-5) Avail: NTIS HC $3.00

The development of remote sensing techniques in Europe and their application to earth resources surveys are discussed. A survey of activities carried out in European countries and through ESRO is presented. It is pointed out that European geophysicists are not sufficiently informed about these techniques due to the fact that they were developed essentially for military applications. A proposal is outlined for a future medium-term European program. ESRO

N72-27382# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
DYNAMIC BEHAVIOR OF ELECTRONS: EFFECT OF THE DEFORMATION OF THE MAGNETIC FIELD [DYNAMIQUE DES ELECTRONS DANS LA CEINTURE INTERNE DE RADIATIONS: CONTRIBUTION DE LA DEFORMATION DU CHAMP MAGNETIQUE]
A. Gagliardini Paris ESRO Feb. 1972 18 p refs In FRENCH; ENGLISH summary
(ESRO-SN-117) Avail: NTIS HC $3.00

The deformation effect of the magnetic field on particle behavior in the inner radiation belt was studied. The dynamic behavior of electrons in this region of the magnetosphere is characterized by two types of diffusion, namely a radial diffusion of particles towards areas with low values of L, and a tangential diffusion towards areas of high L values in the magnetic field. Experimental results obtained during magnetic stroms show that the latter produce an increase in the electron population in the inner belt through diffusion of particles from the outer belt. Tangential diffusion takes place at high altitudes, through electromagnetic interactions and through other phenomena. At low altitudes, interaction with the constituents of the atmosphere produces a tangential diffusion which may lead to precipitation

of those particles, in particular in the South American anomaly.
Author (ESRO)

N72-27383# European Space Research Inst., Frascati (Italy).
UNSTEADY AXIALLY SYMMETRIC SUPERSONIC FLOW AND THE OSCILLATING SHOCK WAVE
Gjalt R. Smit Paris ESRO Apr. 1972 34 p refs
(ESRO-SN-113) Avail: NTIS HC $3.75

The motion of a curved shock wave in unsteady axially symmetric supersonic flow is investigated. The shock is assumed to be attached to an obstacle consisting of a cone and an axially symmetric afterbody. The motion of the shock is caused either by periodic fluctuations in the upstream flow or by a small periodic motion of the body. Both cases are considered. The flow conditions are adapted to explain some aspects of the oscillatory motion of the earth's bow shock. ESRO

N72-27384# Kiruna Geophysical Observatory (Sweden).
DETECTION OF 2 Hz INFRASOUND PRODUCED BY MOVING AURORAL ELECTROJETS
Ludwik Liszka and Hans Westin Apr. 1972 23 p refs
Sponsored in part by the Res. Inst. of Natl. Defence
(KGO-727) Avail: NTIS HC $3.25

Microphone arrays were used at Kiruna, Sweden, (67.8 N, 20.0 E) to detect 2 Hz infrasound during a number of major geomagnetic storms. The direction of arrival and the horizontal phase velocity of the infrasound at the microphone arrays were obtained. These quantities were compared with motions of the auroral electrojet as determined from geomagnetic observations at five Scandinavian stations. The comparison, using a ray tracing technique, shows that only a part of the observed infrasound may be produced by supersonic motions of auroral electrojets. Author (ESRO)

N72-27385# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
MAGNETOSPHERE-IONOSPHERE COUPLING
Rolf Bostroem May 1972 18 p refs Presented at the COSPAR Symp. on Critical Probl. of Magnetospheric Phys., Madrid, May 1972 Submitted for publication
(TRITA-EPP-72-11) Avail: NTIS HC $3.00

The electric coupling between the magnetosphere and ionosphere is discussed for time independent as well as time dependent fields. Substantial electric currents flow particularly during substorms along the geomagnetic field lines that connect the auroral regions to the magnetosphere. The properties of the current circuits are discussed in terms of idealized analog electric circuits with lumped impedances. The formation of auroral arcs may be an effect of the dynamic interaction of the ionosphere and magnetosphere. If the field-aligned current density exceeds a certain limit, double layers may develop which give rise to non-negligible voltage drops along the field lines and to auroral particle acceleration. The coupling to the ionosphere is of importance also for the convection of the magnetospheric plasma. Author (ESRO)

N72-27386# Centre National de la Recherche Scientifique, Marseilles (France).
TELERS: REMOTE SENSING AND STUDIES OF EARTH RESOURCES. EXPERIMENT PROPOSAL FOR ADVANCED APPLICATIONS FLIGHT EXPERIMENTS (AAFFEE)
[1970] 70 p Partly in ENGLISH and partly in FRENCH Prepared jointly with Groupe d'Etude des Ressources Terrestres par Teledetection Sponsored by CNES
Avail: NTIS HC $6.00

An experiment is proposed for the Earth Resources Program which would involve a study and multispectral color survey in the Mediterranean region, Central Africa, and South Pacific of the lithosphere, hydrosphere, and biosphere. The experiment, operational requirements (also in relation to the Skylab program) as well as the equipment envisaged, are described. ESRO

N72-27387# Teledyne Isotopes, Westwood, N.J.
PROPAGATION OF LONG PERIOD ACOUSTIC GRAVITY WAVES IN THE ATMOSPHERE Final Report
Hernan A. Montes Jan. 1972 64 p refs
(Contract F44620-71-C-0028; ARPA Order 1722; ARPA Order 1316)
(AD-739260; IWL-2757-229; AFOSR-72-0612TR) Avail: NTIS CSCL 04/1

Atmospheric wave data from a multisensor array have been analyzed. It was found that Saturn Apollo launches generate acoustic gravity waves which propagate in the upper atmosphere and induce phase-path fluctuations. The dispersion study of a TID event has been used to illustrate the possibility of deriving neutral atmospheric structure from such type studies. The use of a parametric model to describe the power spectra of the phase-path fluctuations was investigated. Author (GRA)

N72-27388# Naval Postgraduate School, Monterey, Calif.
AMPLITUDE MODULATION OF AN ACOUSTIC WAVE PROPAGATING NEAR THE SEA SURFACE
Wilton J. Smith, Jr. Feb. 1972 88 p refs
(AD-739357; NPS-61MD72021A) Avail: NTIS CSCL 08/10

Sixty kHz CW sound was propagated parallel to and near the ocean surface adjacent to an array of four thermistors, a salinometer, a sound velocimeter, a turbulent velocity probe, and a wave-height probe in order to investigate the statistics and environmental causes of amplitude modulation. The temporal variations of the sound amplitude were studied during four twenty-minute runs over a range of 2 meters at varying depths from near the surface to 14 meters during sea-state one conditions in water of 16 meters-depth. Author (GRA)

N72-27389# Geological Survey, Washington, D.C.
ACOUSTIC REFLECTION PROFILES: EASTERN GREATER ANTILLES
L. E. Garrison 1972 106 p refs
(PB-207596; USGS-GD-72-004) Avail: NTIS HC $3.00 CSCL 08G

Subbottom acoustic-reflection profiles are presented for Leg 3 of an international cruise performed by the U.S. Geological Survey under a program designated the International Decade of Ocean Exploration. Approximately 5,840 km of track line was run throughout the eastern part of the Greater Antilles and the northern part of the Lesser Antilles. The geological setting, preliminary results, and types of equipment used are described, and profiles are reproduced. Two trackline maps provide hourly location data. Author (GRA)

N72-27390# Geological Survey, Washington, D.C.
ACOUSTIC REFLECTION PROFILES: EAST MARGIN YUCATAN PENINSULA
J. G. Vedder 1972 64 p refs
(PB-207595; USGS-GD-72-003) Avail: NTIS HC $3.00 CSCL 08G

Subbottom acoustic reflection profiles of Leg 2 of an international cruise performed by the U.S. Geological Survey are presented. Approximately 4,450 m of track line was run along the eastern margin of the Yucatan Peninsula. The geological setting, preliminary results, and types of equipment used are described. The profiles are reproduced and a trackline map provides hourly location data. Author (GRA)

N72-27391# Geological Survey, Washington, D.C.
ACOUSTIC REFLECTION PROFILES: BAY OF CAMPECHE
G. W. Moore 1972 104 p refs
(PB-207594; USGS-GD-72-002) Avail: NTIS HC $3.00 CSCL 08G

Unedited subbottom acoustic reflection profiles are presented for Leg 1 of an international cruise performed by the U.S. Geological Survey under a program designated the International Decade of Ocean Exploration. Approximately 7,000 km of track line was run in the southern part of the Bay of Campeche in an

area about 200x250 km sq. The geological setting, preliminary results, and types of equipment used are described.
Author (GRA)

N72-27392# Geological Survey, Washington, D.C.
ACOUSTIC REFLECTION PROFILES: VENEZUELA CONTINENTAL BORDERLAND
E. A. Silver 1972 123 p refs
(PB-207597; USGS-GD-72-005) Avail: NTIS HC $3.00 CSCL 08G

Unedited copies of subbottom acoustic reflection profiles of Leg 4 of an international cruise are presented. Approximately 8,000 km of trackline was run along the continental borderland of Venezuela. The geological setting, preliminary results, and types of equipment used are described. Author (GRA)

N72-27393# Teledyne Geotechnical, Alexandria, Va. Seismic Data Lab.
GENERALIZED LINEAR FILTERING OF SEISMIC ARRAY DATA
P. R. Lintz, R. L. Sax, and R. R. Blandford 8 Oct. 1971 89 p refs
(Contract F33657-70-C-0941; ARPA Order 1714)
(AD-739178; SDL-269) Avail: NTIS CSCL 17/10

The theory of generalized linear filtering (Oppenheim, 1966, 1969) is applied to the problem of averaging the transfer functions between a seismic source and seismic recording stations on a continental-sized array. To provide synthetic data for a test of the processor, a simple source signal is passed through nine different random perturbations of a velocity-depth structure yielding nine different synthetic seismograms. Two nuclear explosions (LONGSHOT and MILROW) and an Andreanoff Islands event (22 November 1965) are also processed. The earthquake appears to have longer time terms remaining after generalized linear filtering and the nuclear events appear more similar (before the arrival of the depth phase). Author (GRA)

N72-27394# Teledyne Geotechnical, Alexandria, Va. Seismic Data Lab.
ANALYSIS OF SHORT PERIOD SEISMIC SIGNALS AND NOISE RECORDED AT LASA AND TFO
Herman J. Mecklenburg and Robert P. Masse 21 Sep. 1971 52 p refs
(Contract F33657-72-C-0009; ARPA Order 1714)
(AD-739181; SDL-276) Avail: NTIS CSCL 17/10

Short-period beams were formed for twenty-four events recorded at both the LASA and TFO arrays. The mean RMS noise in the frequency range 0.4-3.0 Hz for the LASA beams was 0.16 millimicron, and for the TFO beams 0.13 millimicron. Noise reduction by beam formation in the range 0.4-3.0 Hz varied from 17 to 23 db for LASA, from 12 to 18 db for the 37-sensor TFO array, and from 6 to 14 db for the 19-sensor TFO subarray. Averaging over several source regions in the distance range 25 degrees -delta-90 degrees, the signal-to-noise ratio for LASA was about one db better than that of TFO for common events. The improvement in signal-to-noise ratio for LASA beams was found to increase 4 db by changing the number of sensors employed in the beams from 48 to 340 while keeping the minimum sensor spacing greater than or = 1km.
Author (GRA)

N72-27395# Aerospace Corp., El Segundo, Calif. Lab. Operations.
CROSS SECTIONS FOR EMISSION OF LYMAN ALPHA RADIATION IN COLLISIONS OF 1-25 kEV PROTONS AND HYDROGEN ATOMS WITH CONSTITUENTS OF PLANETARY ATMOSPHERES Technical Report, Jul. - Nov. 1971
John H. Birely and Robert J. McNeal 31 Jan. 1972 22 p refs
(Contract F04701-71-C-0172)
(AD-739184; TR-0172(9260-01)-12; SAMSO-TR-72-36) Avail: NTIS CSCL 04/1

Cross sections are reported for emission of Lyman-alpha radiation in collisions of a charge-equilibrated 1-25 keV hydrogen beam with N2, O2, CO, CO2, NH3, CH4, and H2. For each target molecule, the separate cross sections for formation of H(2p) and H(2s) in H(-) and H collisions and the fractional population of these projectiles in a charge-equilibrated beam are used to calculate the effective cross section for formation of H(2p) and H(2s). Individual contributions to the overall Lyman-alpha intensity owing to projectile and dissociative excitation are presented for the hydrogen-containing compounds. The results show that, for both projectile and dissociative excitation, collisions involving impact of fast hydrogen atoms rather than protons are the major source of Lyman-alpha production in an aurora. Projectile excitation is demonstrated to be a substantially more important source of Lyman alpha than dissociative excitation in the 1-25 keV energy range.
Author (GRA)

N72-27396# Teledyne Geotechnical, Alexandria, Va.
EVALUATION OF THE LARGE ARRAY LONG PERIOD NETWORK
Harry Mack 17 Dec. 1971 40 p
(Contract F33657-71-C-0510; ARPA Order 1620)
(AD-739174; Rept-4) Avail: NTIS CSCL 17/10

A continuous analysis of LASA long period data has shown that the Rayleigh wave detection rate is quite poor for events located to the south of the array and to be best for events from the northwest. A comparison of Kurile earthquakes recorded by LASA and NORSAR indicates that the Rayleigh wave detection rates are similar for events with body wave magnitudes greater than or equal to 4.0 and that surface waves from such small events are consistently detected. Author (GRA)

N72-27397# Teledyne Geotechnical, Alexandria, Va.
DETECTION THRESHOLD OF THE LASA/SAAC SYSTEM
D. C. Dean 17 Dec. 1971 24 p ref
(Contract F33657-71-C-0510; ARPA Order 1620)
(AD-739173) Avail: NTIS CSCL 17/10

An estimate of the detection threshold of a seismic observatory can be obtained from recurrence curves. Since one expects small events to occur more frequently than larger events, a plot of the number of events detected at LASA versus their magnitude over a long interval of time will fail to increase as magnitude decreases when the detection threshold is reached and small events are lost in the noise. At LASA the 90 percent discrete threshold occurs at magnitude 3.9, and the 90 percent cumulative threshold occurs at magnitude 3.7 for events within 30 to 85 degrees of LASA. Author (GRA)

N72-27398# Teledyne Geotechnical, Alexandria, Va.
SEISMIC ARRAY ANALYSIS CENTER Final Report
W. C. Dean 31 Jan. 1972 21 p refs
(Contract F33657-71-C-0510; ARPA Order 1620)
(AD-739172) Avail: NTIS CSCL 17/10

The purpose of the report is to summarize the Seismic Array Analysis Center (SAAC) activities, results, and evaluation reports. The primary objective during 1971 was to evaluate the SAAC automated data acquisition and processing systems.
Author (GRA)

N72-27399# Israel Program for Scientific Translations, Ltd., Jerusalem.
EARTHQUAKES AND THE DEEP STRUCTURE OF THE SOUTH KURILE ISLAND ARC
S. A. Fedotov, ed., A. M. Bagasarova, I. P. Kuzin, and R. Z. Tarakanov 1971 255 p refs Transl. into ENGLISH from Zemletryaseniya i Glubinnoe Stroenie Yuga Kurilskoi Ostrovnoi Dugi (Moscow), 1969 212 p Sponsored by NSF
(TT-70-50126) Avail: NTIS CSCL 08K

Presented are: Brief data on the investigated region and the southern Kurile network of regional seismic stations; velocity profiles and methods for determination of local coordinates;

absorption of transverse seismic waves in the upper mantle and energy classification of southern Kurile earthquakes; seismicity in the Kurile Island arc; seismic regime of the Etorofu earthquake focal area in 1958-1964; distribution of earthquakes, properties of the upper mantle and the deep structure in the south of the Kurile Island Arc; and catalogue of Southern Kurile Earthquakes.
GRA

N72-27400# Israel Program for Scientific Translations, Ltd., Jerusalem.
ORIGIN OF SALINE SOILS AND THEIR REGIME, VOLUME 1
V. A. Kovda 1971 620 p Transl. into ENGLISH from Akad. Nauk SSSR. Pochv. Inst., Tr. (USSR), No. 1, 1946 573 p Sponsored by NSF
(TT-70-50169) Avail: NTIS CSCL 08M

Contents: General patterns of salt migration and accumulation; processes of salination of soils, grounds, and ground waters; and moisture and salt regime of saline soils.
GRA

N72-27401# Inter-American Geodetic Survey, Fort Clayton (Canal Zone). Natural Resources Div.
NATURAL RESOURCES-CADASTRAL INVENTORY, NICARAGUAN PILOT PROJECT, 1965 - 1966
Mar. 1966 126 p refs
(PB-207385; TA/OST-AN-66-3-1) Avail: NTIS HC $3.00 CSCL 08F

In preparation for a comprehensive cadastral and natural resources survey of Nicaragua, a pilot survey was undertaken in an agricultural area in the vicinity of Leon. The primary purpose was to provide orientation for Nicaraguan specialists in leading roles in the planning and execution of the comprehensive survey. A description of the geology, geomorphology, climatology, hydrology, soils, land use, and cadastral aspects of the region as determined by the survey are presented. Author (GRA)

N72-27402# Ohio State Univ., Columbus. Dept. of Geodetic Science.
KINEMATICAL GEODESY 2
Helmut Moritz Oct. 1971 62 p refs
(Contract F19628-69-C-0127; AF Proj. 7600)
(AD-737799; DGS-165; AFCRL-71-0551; SR-17) Avail: NTIS CSCL 08/5

The report is a continuation of a previous OSU report, "Kinematical Geodesy" (1967). Part A gives basic principles and the theoretical foundations for the separation of gravitation and inertia by a combined accelerometer-gradiometer system, with applications to aerial gravimetry and to inertial navigation. In Part B, proposed methods for the geodetic use of second-order gradients are briefly described and evaluated. The new technique of least-squares collocation avoids the shortcomings of those methods. The application of this technique to the use of gradients for the determination of the gravity field and of spherical harmonics is investigated. Au hor (GRA)

N72-27403# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
ATMOSPHERIC TIDAL MEASUREMENTS AT 50 Km FROM A CONSTANT-ALTITUDE BALLOON
Harold N. Ballard, Norman J. Beyers, Bruce T. Miers, Miguel Izquierdo, and John Whitacre Dec. 1971 34 p refs
(DA Proj. 1T0-61102-B-53-A)
(AD-739486; ECOM-5417) Avail: NTIS CSCL 04/1

A balloon, the second in a series of high-altitide balloon flights, was launched to a record altitide of 50 Km from White Sands Missile Range, New Mexico on 22 September 1969. The 870,000 cubic meter, helium-filled, zero-pressure, polyethelene balloon served as a constant-level stable support for an instrument payload consisting of bead thermistor atmospheric and balloon-skin temperature sensors, thermal conductivity pressure gauge, a forward-scattering beta-ray atmospheric density gauge, chemiluminescent ozonesondes, a Geiger tube cosmic ray detector, and an accelerometer for the determination of the vertical component of balloon acceleration. Radar position-time data served to determine the wind velocity. The paper discusses specifically the variations in the observed balloon trajectory, the supporting rocketsonde-determined winds and the balloon-borne temperature sensor values as related to the existence of a diurnal atmospheric tide near 50 Km. It also presents the related data obtained from the other instruments comprising the payload. Author (GRA)

N72-27404# Scripps Institution of Oceanography, San Diego, Calif. Advanced Ocean Engineering Lab.
[OCEAN SURFACE, BOTTOM, AND NEAR SHORE ENGINEERING] Semiannual Report, 1 Jul. - 31 Dec. 1971
William A. Nierenberg, Fred N. Spiess, Walter H. Munk, William A. Prothero, Douglas L. Inman, and William G. VanDorn 31 Dec. 1971 122 p refs
(Contract N00014-69-A-0200-6012; ARPA Order 1348; ARPA Order 1730; ARPA Order 1607; NR Proj. 293-005)
(AD-738476; AOEL-26; SIO-Ref-72-2) Avail: NTIS CSCL 08/3

The semi-annual report reflects the technical status of projects conducted within the Advanced Ocean Engineering Laboratory at the Scripps Institution of Oceanography. The projects are: Stable Floating Platform - to conceive, design build and demonstrate the feasibility of large stable floating platforms in the open sea. Benethic Array - a program to develop and construct a quartz vertical accelerometer. Advanced Studies in Nearshore Engineering - Electromagnetic Roughness of the Ocean Surface utilization of radio signals scattered from the sea surface to determine the directional spectrum of ocean waves.
Author (GRA)

N72-27405# Aerospace Corp., El Segundo, Calif. Lab. Operations.
TRANSIENT STRUCTURE OF AN ARTIFICIAL RADIATION BELT Technical Report, Jul. - Dec. 1971
M. Schulz 31 Mar. 1972 17 p refs
(Contract F04701-71-C-0172)
(AD-739495; TR-0172(2260-20)-16; SAMSO-TR-72-58) Avail: NTIS CSCL 04/1

Estimates are derived for the maximum flux (vs. azimuth) as a function of time following the detonation of a single source of radiation-belt electrons. All results are expressed in terms of the azimuthally averaged flux ultimately injected by the one event.
Author (GRA)

N72-27406# Army Topographic Command, Washington, D.C.
AN ANNOTATED BIBLIOGRAPHY OF REMOTE SENSING OF AIR AND WATER POLLUTION
Paul Dennis Brooks and George W. Thomson Sep. 1971 26 p refs
(AD-737588) Avail: NTIS CSCL 13/2

The annotated bibliography represents an attempt to compile a complete list of literature published between 1965 - 1970 on the subject of remote sensing of air and water pollution. The general types covered include: Airborne and spacecraft surveillance; photogrammetric lidar nephelometers; non-dispersive infrared optical interferometer; aerial panchromatic photography; aerial infrared imagery; radiophase; and earth resistivity measurements. GRA

N72-27101 Stanford Research Inst., Menlo Park, Calif.
TRIGGERED LIGHTNING AND SOME UNSUSPECTED LIGHTNING HAZARDS
Edward T. Pierce *In* ONR Naval Res. Rev., Vol. 25, No. 3 Mar. 1972 p 14-33 (For availability see N72-27099 18-05)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N72-27407 National Lending Library for Science and Technology, Boston Spa (England).
THE CONSTRUCTION AND OPERATION OF A COUNTER-CURRENT CONTINUOUS GAS CHROMATOGRAPH
S. Araki Apr. 1972 15 p refs Transl. into ENGLISH from Kogyo Kagaku Zasshi (Tokyo), v. 74, no. 4, 1971 p 113-118, 651-656
(NLL-RTS-6992) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.50; 5 NLL photocopy coupons

The development of a countercurrent continuous gas chromatograph is reported with increased sample throughput through increased cross sectional column area. Test results show that a 30 mm column provides a better separation capacity than the 6 mm column. G.G.

N72-27408* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AUDIO FREQUENCY MARKER SYSTEM Patent
Edward A. Cohen and Stanley L. Manatt, inventors (to NASA) Issued 13 Jun. 1972 6 p Filed 11 Aug. 1970 Supersedes N72-15417 (10 - 06, p 0770) Sponsored by NASA
(NASA-Case-NPO-11147; US-Patent-3,670,241; US-Patent-Appl-SN-63195; US-Patent-Class-324-79R; US-Patent-Class-328-189; US-Patent-Class-331-44) Avail: US Patent Office CSCL 14B

A system for providing a precise temporal display, or record, of the frequencies through which a sweeping audio frequency signal is swept, is presented. A sweeping audio frequency signal, of which the exact frequency with respect to time is unknown, is applied as an input to a pulse generator for the purpose of generating a train of pulses having a pulse repetition rate which is the same as the frequency of the applied signals. The train of pulses is applied to a mixer circuit for the purpose of being mixed with a signal having a known frequency with respect to time. The beat frequency signals generated by the mixer circuit are applied to an appropriate display device, such as a chart recorder, for the purpose of providing the desired display or record. Official Gazette of the U.S. Patent Office

N72-27409* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LIGHT DIRECTION SENSOR Patent
Alan R. Johnston, inventor (to NASA) Issued 13 Jun. 1972 5 p Filed 1 Oct. 1970 Supersedes N72-15421 (10 - 06, p 0771) Sponsored by NASA
(NASA-Case-NPO-11201; US-Patent-3,670,168; US-Patent-Appl-SN-77220; US-Patent-Class-250-225; US-Patent-Class-250-203R; US-Patent-Class-350-147; US-Patent-Class-356-141; US-Patent-Class-356-152) Avail: US Patent Office CSCL 20F

A light direction sensor for providing third axis control of spacecraft is presented. The light direction sensor is a direction-sensitive modulator positioned before a set of telescopic light gathering optics which, in turn, is followed by a detector. The direction-sensitive modulator is a birefringent crystal cut at suitable angles so that the retardation suffered by the light beam would be dependent upon the direction from which the light beam is incident upon the crystal. The crystal is coupled with an electro-optic phase modulator which adds a sinusoidal retardation to the light beam. The crystal and modulator are positioned between crossed polarizers to convert the beam retardation to intensity varying at a certain frequency. The transmitted intensity is then collected by the telescopic optics and led to the detector. Official Gazette of the U.S. Patent Office

N72-27410* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPARATUS FOR SENSING TEMPERATURE Patent
Ronald G. Huff, inventor (to NASA) Issued 20 Jun. 1972 3 p Field 18 Nov. 1969 Supersedes N70-22135 (08 - 09, p 1635)
(NASA-Case-XLE-05230; US-Patent-3,671,329; US-Patent-Appl-SN-877717; US-Patent-Class-136-233) Avail: US Patent Office CSCL 14B

A device for measuring the surface temperature of a wall heated by a flowing fluid without disturbing the boundary layer is discussed. The device consists of a fine wire with a quartz jacket with an outside diameter of .003 inches used as one leg of a thermocouple. A small length of the wire is exposed by removing a portion of the quartz jacket and is attached to the surface of the wall. The wall temperature is determined by reading the voltage generated by the thermocouple junction formed by the wire and the material from which the wall is fabricated. Official Gazette of the U.S. Patent Office

N72-27411* Lockheed Electronics Co., Houston, Tex.
ULTRASTABLE CALIBRATED LIGHT SOURCE Patent
Michael F. Heidt, John E. Novotny, and Naranappa K. Shankar, inventors (to NASA) Issued 13 Jun. 1972 8 p Filed 31 Jul. 1970 Supersedes N70-36029 (08 - 19, p 3543) Sponsored by NASA
(NASA-Case-MSC-12293-1; US-Patent-3,670,202; US-Patent-Appl-SN-59956; US-Patent-Class-315-297; US-Patent-Class-315-158; US-Patent-Class-250-205; US-Patent-Class-315-307; US-Patent-Class-315-310; US-Patent-Class-315-311; US-Patent-Class-315-151; US-Patent-Class-315-156) Avail: US Patent Office CSCL 20F

Light from an electrically powered light source is optically monitored by a transducer which converts the optical signal to an electrical error signal. The error signal is compared with a reference signal and a signal representing the difference between the reference and the error signals is generated. The difference signal is employed to control an electronic switching network which in turn regulates the electrical power input to the light source to maintain a constant light level at the optical monitor. Official Gazette of U.S. Patent Office

N72-27412* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FIXTURE FOR SUPPORTING ARTICLES DURING VIBRATION TESTS Patent
David J. Light, inventor (to NASA) Issued 20 Jun. 1972 5 p Filed 5 Oct. 1970 Supersedes N72-15425 (10 - 06, p 0771)
(NASA-Case-MFS-20523; US-Patent-3,670,563; US-Patent-Appl-SN-77786; US-Patent-Class-73-71.6; US-Patent-Class-73-103) Avail: US Patent Office CSCL 14B

A fixture is described for supporting and securing articles, such as electrical components, during vibration testing. The articles comprising an integral annular unit having a series of spaced blind cavities formed in its top surface and a series of spaced blind cavities formed around its outer surface. Articles to be vibration tested are secured in the cavities of the fixture, and the fixture is mounted on the driver head of a vibration exciter whereby the fixture is aligned with the driver coil of the exciter. The cavities may be in the form of partially threaded bores with an intermediate shoulder to receive a disk and clamping nut for securing test items in the bores. Official Gazette of the U.S. Patent Office

N72-27413 National Lending Library for Science and Technology, Boston Spa (England).
MEASUREMENTS IN TURBULENT FLOW: HOT WIRE ANEMOMETRY
M. Ribon 20 Apr. 1972 51 p refs Transl. into ENGLISH from Bull. Dir. Etud. Rech., Ser. A. (France), no. 4, 1970 p 5-52
(NLL-Trans-T-1521-(9022.305)) Avail: Natl. Lending Library, Boston Spa, Engl.: 6 NLL photocopy coupons

The principle of the hot-wire anemometers is described along with techniques for measuring values characterizing the

structure of turbulent flow. The currently used probes and their responses are discussed. The static calibration of a hot-wire anemometer is presented; experimental results are included.
F.O.S.

N72-27414 National Lending Library for Science and Technology, Boston Spa (England).
INFRARED ANALYSERS AND OTHER INDUSTRIAL PHOTOMETERS
W. Schaefer 7 Mar. 1972 26 p refs Transl. into ENGLISH from VDI-Ber. (Duesseldorf), v. 97, 1966 p 15-23
(NLL-SMRE-Trans-5691-(8313.4)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

A group of measuring instruments described as industrial photometers is described. These are instruments for analyzing gases and liquids, the basic principle of which is the absorption of electromagnetic radiation in the wavelength region from the UV to the middle of the infrared region. Analysis in this connection means the quantitative determination of a gas or liquid component in a mixture of substances. These instruments, in contrast to the spectrophotometers universally used in chemical laboratories for tasks which vary from day to day, are set up from the beginning for a specific measurement problem for which they have been adjusted by the manufacturer. To use them for a different measurement problem or component means more or less extensive changes. Author

N72-27415 Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
BIBLIOGRAPHY OF MAGNETOMETER, VOLUME 43, NO. 8
P. H. Serson and F. Primdahl 1972 9 p refs
(M70-43/8) Copyright. Avail: Issuing Activity

A reference list of selected papers describing techniques and instruments for measuring the earth's magnetic field was prepared for the International Association of Geomagnetism and Aeronomy. It includes nearly 200 references, concentrating on developments since 1950 in methods of geomagnetic measurement. Author

N72-27416 National Lending Library for Science and Technology, Boston Spa (England).
USE OF DATA ACQUISITION SYSTEM IN CALORIMETRY
F. Massazza and U. Costa 7 Jun. 1972 12 p refs Transl. into ENGLISH from Il Cemento (Italy), no. 3, 1970 p 117-122
(NLL-Lib-Comm-1656-(5196)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A platinum thermometer connected to a data acquisition system and coupled to a digital voltmeter is used for automatic recording of calorimeter temperatures. Resolution and stability of the described instrument provide for a period of several months a precision of 0.001 C in differential measurements, and of 0.01 C in absolute measurements. G.G.

N72-27417 National Lending Library for Science and Technology, Boston Spa (England).
A CALORIMETER AS A STANDARD DEVICE TO MEASURE ENERGY DOSES AND THE DETERMINATION OF MEAN ENERGY OUTPUT TO GENERATE AN ION PAIR IN AIR
B. A. Engelke and K. Hohlfeld [1972] 17 p refs Transl. into ENGLISH from PTB-Mitteilungen (West Germany), v. 5, 1971 p 336-342
(NLL-M-22434-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A quasi-adiabatic calorimeter designed for standard measurements of the absorbed dose produced in graphite by photons with energies E greater than 0.5 MeV is described in detail. In the dose range above 50 rads the accuracy is better than 1 percent. Temperature drift rates can be reduced below 0.000001 K/min. By calorimetric measurement of the absorbed dose and measurement of the ionization per unit mass of air under the same conditions, the average energy expended in air to form one ion pair was determined as (33.72 plus or minus 0.51) eV for gamma radiation of 0.67 MeV. Author

N72-27418 National Lending Library for Science and Technology, Boston Spa (England).
SENSITIVITY CHANGES IN NEUTRON DETECTORS IN VARIABLE GAMMA FIELDS
V. V. Charychanskii 7 May 1972 19 p refs Transl. into ENGLISH of USSR report 2437
(NLL-WH-Trans-324-(9091.9F); Rept-2437) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The reasons for sensitivity changes in neutron detectors in intense gamma fields are examined. The effect of statistical addition of neutrons and gamma pulses and its influence on detector neutron sensitivity are investigated in detail. The possibility of stabilizing detector sensitivity in a variable gamma field is considered. Author

N72-27419# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
HOT WIRE ANEMOMETER MEASUREMENTS IN A HYPERSONIC GUN TUNNEL
E. R. Bergstrom and S. Raghunathan Feb. 1972 45 p refs Revised
(Contract B/SR/8362)
(TT-7205-Rev) Avail: NTIS HC $4.25

Preliminary hot-wire anemometer studies are reported in the Mach 7 free-jet flow of the Loughborough University of Technology gun tunnel. A commercially available constant temperature hot-wire anemometer was used to measure the jet fluctuations in mass flow and total temperature at stagnation temperatures and pressures of up to 775 K and and 610 psia, respectively. Maximum values of 6% rms mass flow and 0.5% rms total temperature fluctuations have been recorded. Power spectra of the hot-wire signals show that disturbance frequencies extend up to at least 80KHz with most energy contained in frequencies below 20 KHz. The linear form of the Kovasznay mode diagrams suggests that the principal type of disturbance in the jet is a pressure fluctuation. Over the range of unit Reynolds number 26,700 to 47,200 per inch the rms static pressure fluctuation is estimated to decrease from 8.5% to 4.2%. These preliminary results are considered to be most encouraging With the development of additional wire calibration methods, the constant temperature hot-wire anemometer should furnish accurate data on the nature of the unsteady aerodynamic environment generated in a gun tunnel. Author

N72-27420# Bureau of Mines, Bartlesville, Okla.
A CHEMILUMINESCENCE DETECTOR FOR OZONE MEASUREMENT
H. Carroll, B. Dimitiades, and R. M. Ray 1972 20 p refs Sponsored in part by EPA
(BM-RI-7650) Avail: NTIS HC $3.00

An ozone detector was built and evaluated for its applicability in smog-chamber studies. The detection method is based on the reaction of ozone with ethylene and the measurement of resultant chemiluminescence. In the first phase of evaluation, the detector's response to ozone was studied as a function of several instrument parameters, and optimum conditions were defined for the maximum and most stable responses to ozone. In subsequent evaluations, the method was checked for sensitivity, precision, and interferences and was compared with two alternative methods. Results showed the chemiluminescence method to be acceptably sensitive and precise for smog-chamber studies and superior to the Mast ozone meter and KI (colorimetric 1 percent neutral-potassium iodide method) methods in that it is specific for ozone. Author

N72-27421*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ULTRASONIC SCANNER FOR RADIAL AND FLAT PANELS Patent Application
Robert L. Spencer and Ewing K. Hill, inventors (to NASA) Filed 27 Mar. 1972 16 p
(NASA-Case-MFS-20335-1; US-Patent-Appl-SN-238263) Avail: NTIS HC $3.00 CSCL 14B

An ultrasonic scanning mechanism is reported that scans honeycomb panels or penels with welded seams. It encorporates a mechanism which by simple adjustment is adapted to scan either a radial panel or a flat panel to detect flaws. The supporting structure takes the form of a pair of spaced rails. An immersion tank is positioned between rails and below their level. A work holder is mounted in this tank and is adapted to hold either a flat panel or a radial panel. A travelling bridge is movable along rails and a carriage is mounted on the bridge. NASA

N72-27422*# Kansas Univ., Lawrence.
ON THE USE OF SPACE PHOTOGRAPHY FOR IDENTIFYING TRANSPORTATION ROUTES: A SUMMARY OF PROBLEMS
David S. Simonett, Floyd M. Henderson, and Dwight D. Egbert Jan. 1970 25 p Prepared for Geological Survey, Washington, D. C.
(NASA Order W-12570; Contract USGS-14-08-0001-10848) (NASA-CR-127530; USGS-IR-NASA-171) Avail: NTIS HC $3.00 CSCL 14E

It has been widely suggested that space photography may be used for updating maps of transportation networks. Proponents of the argument have suggested that color space photographs of the resolution obtained with Hasselblad 80 mm lenses (about 300 feet) contain enough useful information to update the extensions of major U. S. highways. The present study systematically documents for the Dallas-Fort Worth area the potential of such space photography in detecting, and to a lesser degree identifying, the existing road networks. Color separation plates and an enlargement of the color photograph were produced and all visible roads traced onto transparencies for study. Major roads and roads under construction were the most visible while lower class roads and roads in urban areas had the poorest return. Road width and classification were found to be the major determinant in visibility, varying from 100 per cent visible for divided highways to 15 per cent visible of bladed earth roads. In summary, space photographs of this resolution proved to be difficult to use for accurate road delineation. Only super highways in rural areas with the greatest road-width were completely identifiable, the width being about 1/3 that of the resolution cell. Author

N72-27423*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FUNCTIONAL CHARACTERISTICS OF THE OGO MAIN BODY AIRGLOW PHOTOMETER
Edith I. Reed, Walter B. Fowler, and Jacques E. Blamont (Centre Natl. de la Rech. Sci., Verrieres-le-Buisson, France) May 1972 24 p refs
(NASA-TM-X-65926; X-625-72-174) Avail: NTIS HC $3.25 CSCL 14B

The OGO-4 main body airglow photometer used a trialkali cathode photomultiplier to sense light at selected wavelengths between 2500 and 6300A corresponding to important emissions in the aurora and night airglow at emission rates ranging from a few rayleighs to about 200 kilorayleighs. The optical, electronic, and mechanical systems are described in terms of their functional characteristics. Author

N72-27424*# Litton Industries, Beverly Hills, Calif.
APPARATUS FOR SAMPLING PARTICULATES IN GASSES Patent Application
Rex C. Wood, inventor (to NASA) Filed 20 Mar. 1972 17 p (Contract NASw-1395)
(NASA-Case-HQN-10037-1; US-Patent-Appl-SN-235957) Avail: NTIS HC $3.00 CSCL 14B

An improved apparatus for sampling particulate material in gasses of the type comprising the combination of a slit impactor and air ejector pump is reported. The apparatus consists of an air ejector pump, a primary nozzle in the air ejector pump, a source of compressed gas for supply to the primary nozzle and a collection cylinder with slit impactors at the cylindrical surface. The apparatus has a pneumatic actuator which is operated by compressed gas fed to the actuator from the same valved supply line which supplies the ejector pump. The actuator is connected to the collection cylinder in such a manner that when the compressed gas is fed to the actuator the collection cylinder is moved outside of the storage casing. When the collection cylinder is stowed in the storage casing, sampling surfaces are isolated from outside atmosphere to prevent contamination of the sampled particulates. NASA

N72-27425*# General Electric Co., Philadelphia, Pa.
ELECTROPHORETIC SAMPLE INSERTION Patent Application
Louis R. McCreight, inventor (to NASA) Filed 6 Jun. 1972 11 p Sponsored by NASA
(NASA-Case-MFS-21395-1; US-Patent-Appl-SN-260093) Avail: NTIS HC $3.00 CSCL 14B

Two conductive screens located in the flow path of an electrophoresis sample separation apparatur are charged electrically. The sample is introduced between the screens, and the charge is sufficient to disperse and hold the samples across the screens. When the charge is terminated, the samples are uniformly distributed in the flow path. Additionally, a first separation by charged properties has been accomplished. NASA

N72-27426# Aeronautical Research Labs., Melbourne (Australia).
TRANSONIC WIND TUNNEL TESTS OF A DUAL SYSTEM (VANES, PRESSURE TAPS) GUST PROBE AND A PITOT-STATIC PROBE MOUNTED SIDE BY SIDE
G. F. Forsyth Jan. 1972 59 p refs
(ARL/A-Note-334) Avail: NTIS HC $5.00

A dual system gust measuring probe has been tested in the transonic wind tunnel primarily to provide a calibration at Mach numbers between 0.4 and 0.9 and at incidence and yaw angles in the range plus or minus 5 deg. The probe consisted of a bluff body with extended tube type pressure tappings and two lifting vanes mounted 6 in. from the probe head. The test results show the gust probe produces pilot instrument errors similar to those for a previous probe without the vanes. The Chaffois probe produced a small effect on the gust probe pressures but no effect on the vanes. Both differential pressures and vane loads were satisfactory in this range, the vanes being more linear but showing more offset due to the asymmetric mounting. Effect of the vanes on differential pressures was significant but predictable. The gust probe static pressure was always too high but comparable with previous results. Author

N72-27427# National Aerospace Lab., Tokyo (Japan).
A HIGH SENSITIVE ATMOSPHERIC TEMPERATURE MEASURING APPARATUS
Kenji Nishio, Hiroyuki Nouse, Takeshi Koshinuma, Shigeo Inoue, Hiroshi Usui, and Toshimi Ohata 1972 12 p refs In JAPANESE; ENGLISH summary
(NLA-TR-260) Avail: NTIS HC $3.00

A temperature measuring apparatus for atmospheric turbulence studies is designed and examined. Ten sets of thermocouples are connected in series and an anti-electro noise amplifier is used to measure accurately the input signals from the probe installed on an aircraft. The probe is calibrated in a wind tunnel at Mach numbers ranging from 0.1 to 0.3 and by environmental tests in air at various temperatures. Author

N72-27428# National Aerospace Lab., Tokyo (Japan).
FLUIDIC TURBINE INLET GAS TEMPERATURE SENSOR
Kenji Nishio, Masanori Endo, and Atsukazu Endo 1972 29 p In JAPANESE; ENGLISH summary
(NAL-TR-265) Avail: NTIS HC $3.50

The development of fluidic turbine inlet gas temperature sensors is discussed. The sensors have two outstanding features: (1) the output port is smaller than the main nozzle in cross section, and (2) the feedback path cross section area increases and remains constant up to the control port. These features

produce a temperature sensor with high resolution, low noise, and large amplitude output signal. Performance test results and mathematical models are included to define the performance of the sensors. Author

N72-27429# National Aerospace Lab., Tokyo (Japan).
STUDY OF A ROTARY DRIVE VIBRATORY OUTPUT RATE GYRO
Hiroshi Yamada 1972 17 p refs In JAPANESE; ENGLISH summary
(NAL-TR-259) Avail: NTIS HC $3.00

A rotary drive vibratory-output rate gyro is studied in order to give damping as an attitude control component of a rocket and other such application. The unconventional rate gyro constructed by mounting an asymmetrical rotor in a gimbal. The moments of inertia of the rotor about its three principal axes are unequal. If the rotor is spun, at a constant angular rate, about one of its principal axes and an angular rate is applied to the rate gyro with a component in the plane of rotor rotation, a vibratory moment at twice the spin frequency of the rotor is developed about a gimbal axis normal to the rotor spin axis. This moment is proportional to the sensed angular rate in magnitude, and has a phase that is related to the direction of the sensed angular rate in the rate sensitive plane Author

N72-27430*# Rocketdyne, Canoga Park, Calif.
HEAT FLOW CALORIMETER Patent Application
William V. Johnston, inventor (to NASA) Filed 16 Jun. 1972 29 p Sponsored by NASA
(NASA-Case-GSC-11434-1; US-Patent-Appl-SN-263498) Avail: NTIS HC $3.50 CSCL 14B

A calorimeter is reported that is capable of measuring thermal output of nickel cadmium batteries or cells during charge-discharge cycles. The device consists of a thermally insulated vessel adapted to receive the object from which liberated heat flow; it maintains a heat sink coupled to the vessel by means of a metal rod which constitutes the only heat exchange path between the vessel and the measured object. Any variation in the amount of heat supplied to the vessel is equal to the amount of heat liberated or absorbed by the object within the vessel. G.G.

N72-27431*# National Oceanic and Atmospheric Administration, Boulder, Colo.
ROCKET BORNE INSTRUMENT TO MEASURE ELECTRIC FIELDS INSIDE ELECTRIFIED CLOUDS Patent Application
Lothar H. Ruhnke, inventor (to NASA) Filed 28 Apr. 1972 13 p Sponsored by NASA
(NASA-Case-KSC-10730-1; US-Patent-Appl-SN-248469) Avail: NTIS HC $3.00 CSCL 14B

An apparatus for measuring the electric field in the atmosphere is described. The apparatus consists of a pair of sensors carried on a rocket for sensing the voltages in the atmosphere. One sensor is an elongated probe having a fine point, which causes a corona current to be produced as it passes through the electric field. An electric current is coupled between the probe and the other sensor and includes a high ohm resistor which linearizes the relationship between the corona current and the electric field being measured. A relaxation oscillator and transmitter generate and transmit an electric signal with a frequency corresponding to the magnitude of the electric field. NASA

N72-27432*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DOUBLE FLOATING PROBE MEASUREMENTS ON S-CUBED A
Nelson C. Maynard and David P. Cauffman (NAS-NRC) Jun. 1972 18 p refs
(NASA-TM-X-65931; X-645-72-201) Avail: NTIS HC $3.00 CSCL 14B

Results of plasmapause measurements made onboard S cubed A (explorer 45) satellite are presented. Data cover model calculations made to explain the observed probe potential behavior, comparison of satellite data with VLF data to establish that certain effects seen are interpretable as the plasmapause, and plasmapause behavior during the December 17, 1971 magnetic storm. Author

N72-27433# Lockheed Missiles and Space Co., Palo Alto, Calif.
ELECTRON OPTICAL DEVICES FOR SOLAR ORIENTATION AND NAVIGATION
Ia. M. Ivandikov [1971] 23 p refs Transl. into ENGLISH from the book "Optiko-Elektronnye Pribory dlia Orientatsii i Navigatsii Kosmich. App." Moscow, Mashinostr., 1971 p 135-168
Avail: NTIS HC $3.25; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Fundamental parameters and operational characteristics are discussed for solar orientation and navigation devices. Considered are solar orientation sensors for space vehicle stabilization and solar position sensors for determinations of spatial positions. G.G.

N72-27434*# Genoa Univ. (Italy).
CRITERIA FOR THE CHOICE OF A CAPACITIVE DEVICE FOR MECHANICAL MEASUREMENTS [CRITERI DI SCELTA DI UN'APPARECCHIATURA CAPACITIVA PER MISURE MECCHANICHE]
Aleramo L. Lucifredi Nov. 1970 20 p refs In ITALIAN Submitted for publication Sponsored jointly by ESRO and NASA
(NASA-CR-127250; IIR-70-AL-147) Avail: NTIS HC $3.00 CSCL 14B

The advantages and disadvantages of different models of capacitive transducers and of various signal conditioning circuits are discussed with particular emphasis on the field of applications. A practical example of a design procedure is discussed. ESRO

N72-27435# Centre National d'Etudes Spatiales, Paris (France).
PROCEEDINGS OF THE THIRD CONFERENCE ON SPACE OPTICS [TROISIEMES JOURNEES D'OPTIQUE SPATIALE]
1971 490 p refs Partly in ENGLISH and partly in FRENCH Conf. held at Marseille, 21-24 Sep. 1971
Avail: NTIS HC $26.50

Results and findings in space optical equipment and techniques are presented. Onboard radiation detectors (photomultipliers, bolometers, image tubes), optical systems, solar sensors, and horizon scanners are described. In addition, procedures for calibrating radiation sources and Meteosat image processing are presented. For individual titles, see N72-27436 through N72-27470.

N72-27436 Radiotechnique-Compelec, Paris (France).
NEW ONBOARD PHOTOMULTIPLIERS [NOUVEAUX PHOTOMULTIPLICATEURS EMBARQUABLES]
J. Nussli *In* CINES Proc. of the 3rd Conf. on Space Optics 1971 p 1-4 In FRENCH (For availability see N72-27435 18-14)

Onboard photomultipliers such as the p.m. 405 F with semi-transparent CsTe (solar blind) cathode, p.m. 405 L with opaque CsTe cathode, p.m. 404 L with S20 cathode, and p.m. 406 F with SbNa2K cathode (high temperature) are reviewed. The development of photomultipliers for the study of the ultraviolet radiation, such as the p.m. 416 F, to be used in the Signe project (France-USSR), the p.m. 403 FUH to be used onboard OSO (France-USA), and the p.m. 413 F series photomultiplier tube, is outlined. ESRO

N72-27437 Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
NEW THERMISTOR BOLOMETERS [NOUVEAUX BOLOMETRES A THERMISTANCE]
G. Bessonneau (Radiotechnique-Compelec (RTC), Paris), F.

Desvignes, and F. Dumont *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 5-24 refs In FRENCH; ENGLISH summary (For availability see N72-27435 18-14)

The basic principles of bolometers and their possible use in space applications are summarized. The technology and structure of these devices are described. The main LEP measurements of functional characteristics are compared to the physical model properties. The detection capability for periodic signals or transients is discussed, and possible applications are outlined.
ESRO

N72-27438 Centre National de la Recherche Scientifique, Verrieres-le-Buisson (France). Lab. de Physique Stellaire et Planetaire.

A NEW HIGH PERFORMANCE LIQUID HELIUM COOLED BOLOMETER FOR FAR INFRARED RANGE [UN NOUVEAU TYPE DE BOLOMETRE REFROIDI A L'HELIUM LIQUIDE DE HAUTES PERFORMANCE POUR L'INFRAROUGE LOINTAIN]

N. Coron, G. Dambier, and J. Leblanc *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 25-38 refs In FRENCH Prepared jointly with Paris Obs. (For availability see N72-27435 18-14)

A bolometer is described in which the absorbing surface is separated from the crystal detecting the temperature variations. This instrument includes three parts and a ferrite absorbing material, deposited on a copper or beryllium high thermal conductivity substrate which is welded on the back side of a germanium doped crystal. Performance characteristics such as the noise equivalent power, detection capability were compared to characteristics of other classical bolometers. It is concluded that use of deposits can improve the selectivity of the three part bolometer and make it suitable for narrow band photometry and high resolution far infrared (20 to 200 microns) spectrometry.
ESRO

N72-27439 Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).

THERMOPILES FOR HORIZON SENSORS [THERMOPILES POUR SENSEURS D'HORIZON]

F. Desvignes, R. Hybois, and J. Lantaires (Radiotechnique-Compelec, (RTC), Paris) *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 39-51 refs In FRENCH; ENGLISH summary (For availability see N72-27435 18-14)

The use of thermopiles as infrared horizon sensors is outlined. Their main specifications, such as performance characteristics, environmental conditions etc., are described. The physical model analyzing sensitivity, electrical resistance, and time constant has shown which construction parameters can be used to modify the main functional characteristics of the thermopiles in order to fulfill the requirements specific to each sensor design. A comparison of experimental and theoretical results is given.
ESRO

N72-27440 Societe Anonyme de Telecommunications, Paris (France).

Cd(x)Hg(1-x)TEe DETECTOR FOR SPACE [DETECTUER Cd(x)Hg(1-x)Te POUR USAGE SPATIALE]

A. Sorrentino and J. Ameurlaine *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 53-62 In FRENCH (For availability see N72-27435 18-14)

The volt-ampere characteristics and the quantum efficiency of a photovoltaic detector were studied as a temperature function. The use of cadmium telluride-magnesium telluride photodiodes as infrared detectors in aerospace environments was emphasized. A study was carried out on materials, hermetic sealing techniques, and other relevent subjects, based on a method developed for the Meteosat project.
ESRO

N72-27441 Centre d'Etude Spatiale des Rayonnements, Toulouse (France).

THE USE OF CHANNELTRON IN THE FAR ULTRAVIOLET [L'UTILISATION DU CHANNELTRON DANS L'ULTRAVIOLET LOINTAIN]

C. Barat and J. Bouyssou *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 63-80 In FRENCH (For availability see N72-27435 18-14)

The performance characteristics of the Bendix S 3029 X photomultiplier tube for use as a far ultraviolet detector are analyzed. The variation of these characteristics, such as high gain, resolution, and quantum efficiency with different space environment parameters is discussed. It is concluded that the photomultiplier tube is the most sensitive detector for the far ultraviolet range.
ESRO

N72-27442 Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).

THE BEADS OF ELECTRON MULTIPLIER TUBES (MICROCHANNEL PLATES). APPLICATION TO IMAGE TUBES [LES FAISCEAUX DE MULTIPLICATEURS TUBULAIRES D'ELECTRONS (GALETTES DE MICROCANAUX). APPLICATIONS DANS LES TUBES IMAGES]

G. Eschard and J. Graf *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 81-89 refs In FRENCH (For availability see N72-27435 18-14)

The development of microchannel electron multipliers and their applications are discussed. The use of these multipliers in instruments such as photomultipliers and cathode ray tubes, in proximity focusing image tubes, or as particle and radiation detectors is described. The realization of high gain, compact two-dimensional image intensifiers is outlined, and performance characteristics such as light gain, background noise, and resolution are analyzed.
ESRO

N72-27443 Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).

HR 300: A HIGH SPEED, COMPACT, AND ROBUST, MICROCHANNEL PLATE [LE HR 300: UN PHOTOMULTIPLICATEUR A GALETTE DE MICROCANAUX, ROBUSTE, COMPACT ET TRES RAPIDE]

J. P. Boutot and G. Pietri *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 91-96 refs In FRENCH (For availability see N72-27435 18-14)

The performance characteristics of microchannel plate photomultipliers are analyzed and compared with those of conventional photomultipliers. The development of structural design technology and the transfer technique for positioning the photocathode as well as compactness, robust structure, low power consumption, and high speed response make possible the use of microchannel plate photomultipliers in space environments.
ESRO

N72-27444 Centre National de la Recherche Scientifique, Verrieres-le-Buisson (France). Service de Technologie Spatiale.

PHYSICAL LIMITATIONS OF IMAGE TUBES FOR SPACE APPLICATIONS [LIMITATIONS PHYSIQUES DES TUBES IMAGES DESTINES AUX APPLICATIONS SPATIALES]

P. Balaskovic *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 97-117 In FRENCH (For availability see N72-27435 18-14)

The performance characteristics such as resolution, detection threshold, and dynamic response of image analyzers are discussed. Two types of structure are analyzed; photoconductive and photoemissive tubes, and the theoretical physical limitations of both structures are studied.
ESRO

N72-27445 Laboratoire Central de Recherches Thomson, Orsay (France).

THX546: SUPERVIDICON INTEGRATOR FOR THE ULTRAVIOLET [SUPERVIDICON INTEGRATEUR DANS L'ULTRAVIOLET THX546]

M. Blamoutier and M. Beauvais *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 119-130 In FRENCH (For availability see N72-27435 18-14)

The super vidicon image tube for observation of far ultraviolet stellar fields is described. This tube, which consists of an optical fiber assembly of a UV/visible image convertor to a low speed integrator, was developed for the French Faust project and is to be used in conjunction with a UV telescope onboard a stabilized rocket. Performance characteristics are analyzed separately for both parts, and the effect of coupling both electro-optical elements by means of optical fibers is evaluated. The possibility is evaluated for detecting 15 magnitude stars using a combination of a supervidicon to 16mm diameter telescope with a signal integration period of 300 sec and a transmission rate of 128 to 236 K bits/sec. ESRO

N72-27446 Societe d'Etudes et d'Application de Vide Optique et Mecanique, Franconville (France).
REPORT ON RESULTS OBTAINED IN. RESEARCH ON FILTERS AND MIRRORS FOR THE FAR ULTRAVIOLET RANGE [ENSEMBLE DES RESULTATS OBTENUS DANS LE CADRE DES ETUDES DE FILTRES ET MIROIRS POUR L'ULTRAVIOLET LOINTAIN]
A. Malherbe *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 131-138 In FRENCH (For availability see N72-27435 18-14)

The different optical elements obtained by vacuum deposition of thin metallic films and suitable for far ultraviolet studies are reviewed. Mirrors and interferometers for the 1000 to 3000 A range, multidielectric selective reflection mirrors for the 2000 to 3000 A range, and low pass multidielectric interferometers for the 2000 to 3000 A range are described. Their technology is reviewed, and performance characteristics and specifications for use in aerospace environments are analyzed. ESRO

N72-27447 Societe d'Etudes et d'Application de Vide Optique et Mecanique, Franconville (France).
DESIGN AND DEVELOPMENT OF INFRARED FILTERS [ETUDE ET REALISATION DE FILTRES INFRA-ROUGE]
J. Charlier *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 139-147 In FRENCH (For availability see N72-27435 18-14)

An infrared passband filter is described, and its theoretical principles are reviewed. A method for evaluating the bandpass in order to define an imposed passband filter formula is outlined. This method is applied to the design of an infrared bandpass filter which eliminates the wavelengths inferior to 3.50 microns. The filter eliminated the transmissions between 3.50 and 1.70 microns by means of germanium deposits on piles of layers. The wavelengths superior to 5.60 microns are eliminated by means of silica. Transmission efficiency at 4.28 microns is of the order of 64 per cent. ESRO

N72-27448 Jouan-Quetin Jobin-Yvon, Longjumeau (France).
RECENT DEVELOPMENTS IN HOLOGRAPHIC NETWORKS AND SOME APPLICATIONS [PROGRES RECENTS DES RESEAUX HOLOGRAPHIQUES ET QUELQUES APPLICATIONS DE CEUX-CI]
G. Pieuchard and J. Flamand *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 149-153 In FRENCH (For availability see N72-27435 18-14)

An experimental study was carried out to increase the efficiency of holographic gratings. A 33 percent transmission efficiency was obtained for the Lyman alpha radiation using a 3600 lines/mm grating. In addition, 6000 lines/mm flat gratings and 300 mm diameter concave gratings with a 1200 lines/mm path were manufactured. ESRO

N72-27449 Centre National de la Recherche Scientifique, Verrieres-le-Buisson (France). Service d'Aeronomie Spatiale.
THE HOLOGRAPHIC GRATING OF THE D2A POLAR SATELLITE LYMAN BETA EXPERIMENT [LE RESEAU HOLOGRAPHIQUE DE L'EXPERIENCE LYMAN BETA DU SATELLITE D2A POLAIRE]
J. Desalos, J. Porteneuve, S. Vidal, A. Soufflot, and M. Olivie (Soc. de Realisations Opt.) *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 155-170 refs In FRENCH (For availability see N72-27435 18-14)

A narrow angle (16 deg) spectrophotometer sensitive to Lyman beta radiation was developed for use onboard the French D2A polar satellite to study the atomic hydrogen distribution in the earth's atmosphere. Performance characteristics and their effects on spectrophotometer configurations are discussed. Different solutions are proposed, and the results of an experimental study carried out on the use of interference gratings are presented. ESRO

N72-27450 Brest Univ. (France). Faculte des Sciences.
GLOBAL CALCULATIONS OF CONCAVE GRATING ABERRATIONS AND OPTIMIZATION OF RESOLUTION WITH REGARD TO LUMINOSITY [CALCULS GLOBAUX DES ABERRATIONS DES RESEAUX CONCAVES ET DE L'OPTIMISATION DE LA RESOLVANCE PAR RAPPORT A LA LUMINOSITE] **c23**
A. Johannin-Gilles *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 171-181 refs In FRENCH (For availability see N72-27435 18-14)

A concave grating was subdivided into 441 spherical elements and a computer program was used to trace the projections of rays diffracted by the elementary gratings onto a symmetric plane perpendicular to the grating lines. These diffracted rays correspond to the incident rays from point objects located on the entrance slit. The region of optimum convergence for a given wavelength, and thus the correction of results obtained by paraxial optics, can be determined by the systematic study of diffracted ray projections. It is possible to trace curves of equal aberration on the grating surface by computation. The graphical study shows that masking some parts of the gratings, or the use of assymetric gratings, would increase its resolution. ESRO

N72-27451 Engins Matra, Velizy (France). Division Optique.
ULTRASONIC MACHINING [ALLEGEMENT PAR ULTRA-SONS] **c15**
M. B. Busch *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 183-191 In FRENCH (For availability see N72-27435 18-14)

A study was carried out on the application of ultrasonic machining of mirrors. An installation consisting of a low frequency generator, electroacoustic convertor, a mechanical amplifier, and a sonotrode or machining tool is described. The limitations and possibilities of this installation are discussed. A mathematical model for an annular mirror machined in hexagon is presented. It is concluded that the limitations of ultrasonic machining are due to technological problems related to equipment and manufacturing procedures rather than to optical considerations or material resistance. ESRO

N72-27452 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ULTRALIGHT WEIGHT CAST TELESCOPE MIRRORS [MIROIRS DE TELESCOPE MOULES A STRUCTURE ALLEGEE]
M. P. Lemaitre and L. Gramont *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 193-202 refs In FRENCH (For availability see N72-27435 18-14)

Technological developments in the use of onboard ultralightweight mirrors and large diameter ground astronomical telescopes are described. Quality criteria are analyzed with regard to infrared detectors. Results obtained using epoxy resin casting in the manufacture of ultralight honeycomb structures are presented. It is concluded that the use of composite carbon fibers can optimize the mirror structures. ESRO

N72-27453 Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
USE OF KERBER PROFILE SCHMIDT PLATES WITH

DIFFERENT OPTICAL SYSTEMS [UTILISATION DE LAMES DE SCHMIDT A PROFILE DE KERBER DANS DIFFERENTES COMBINAISONS OPTIQUES]
M. Detaille and M. Saisse *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 203-230 In FRENCH; ENGLISH summary (For availability see N72-27435 18-14)

The methods used for the manufacture and quality control of Schmidt plates are described and the advantages of these telescopes, especially Kerber profile Schmidt plates, are outlined. Different applications are presented such as the Janus camera focusing at finite distance and the Maurer and D2B cameras with several mirrors. The problem of optical element positioning is discussed, and possible future applications are considered, such as reflecting Schmidt plates and Kerber profile holographic gratings. ESRO

N72-27454 Centre National d'Etudes Spatiales, Paris (France).
CORRECTION OF THE OPTICAL SURFACE BY VACUUM DEPOSITION [CORRECTION DE SURFACE OPTIQUE PAR DEPOT SOUS VIDE]
M. Fournet and G. Cerutti-Maori (Soc. Natl. Ind. Aerospatiale, Cannes, France) *In its* Proc. of the 3rd Conf. on Space Optics 1971 p 232-241 In FRENCH (For availability see N72-27435 18-14)

The use of materials adjunction for finishing optical surfaces was investigated. The vacuum deposition method developed for the correction of angular defects of the TL2 reflector is outlined, and the vaporizing equipment for dihedral deposition of silica is described. It is concluded that with the corrected reflector approximately the same performance characteristics are obtained as with the TL2 before treatment. Some suggested improvements are listed. ESRO

N72-27455 Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France).
DEGRADATION OF OPTICAL MATERIALS IN SPACE ENVIRONMENTS. MECHANISM OF DEFECT GENERATION [DEGRADATION DES MATERIAUX OPTIQUES EN ENVIRONNEMENT SPATIAL. MECANISMES DE CREATION DE DEFAUTS] **c29**
M. Romero *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 243-247 In FRENCH (For availability see N72-27435 18-14)

Different optical system materials for use in space environments are analyzed to determine which components and materials may be damaged by ionizing radiation or charged particles. The different mechanisms of defect generation are outlined. They include: vacancies induced by collisions in metals, glasses, semiconductors, and covalent compounds; vacancies induced by ionization in ionic crystals; and molecular dissociation. The influence of certain characteristics of radiation is considered. ESRO

N72-27456 Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France).
DEGRADATION OF OPTICAL SYSTEMS IN HIGH ENERGY SPACE ENVIRONMENTS [DEGRADATION DES SYSTEMES OPTIQUES EN ENVIRONMENT SPATIAL ENERGETIQUE] **c29**
J. Bourrieau *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 249-264 refs In FRENCH (For availability see N72-27435 18-14)

Degradation of different optical systems for use in the space environment, such as mirrors, infrared filters, photographic films and plates, lenses and transmission windows, was investigated. Proton and electron irradiation and high energy radiation flux were used to simulate the space environment. The corpuscular and electromagnetic radiation and micrometeorites, which characterize the space environment, and the penetration of particles into the spacecraft, are discussed. ESRO

N72-27457 Centre National de la Recherche Scientifique, Verrieres-le-Buisson (France). Lab. de Physique Stellaire et Planetaire.
DESIGN AND DEVELOPMENT OF MULTICHANNEL SPECTROMETER ONBOARD THE OSO-1 SATELLITE [CONCEPTION ET REALISATION DU SPECTROMETRE MULTICANAUX EMBARQUE SUR LE SATELLITE OSO-1]
G. Artzner and J. C. Vial *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 265-272 In FRENCH (For availability see N72-27435 18-14)

The experiment onboard the American OSO-1 satellite for space-time study of the solar chromosphere is described. It includes an onboard telescope forming a solar image on the entrance slit of a spectrometer which selects six chromosphere spectral lines in the 1025 to 3970 A range. The performance characteristics and optical properties of the spectrometer are discussed. ESRO

N72-27458 Societe Anonyme d'Etudes et Realisations Nucleaires, Limeil-Breuannes (France).
THE D2B SATELLITE SOLAR SENSORS [LES SENSEURS SOLAIRES DU SATELLITE D2B]
J. R. Huriet, J. Jamet, and J. Michel (Lab. d'Electron et de phys. appl., Liheil, France) *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 273-286 In FRENCH (For availability see N72-27435 18-14)

The French D2B satellite solar sensing system for attitude control is described. The optical system will use a servocontrol mechanism with a pointing accuracy of 15 sec of arc. Equipment consisting of a 125 mm diameter solar simulator with a collimation accuracy better than 15 sec of arc, and an energetic flux simulation equal to 1/100 of the solar flux was developed to test the sensor response. ESRO

N72-27459 Centre National d'Etudes Spatiales, Toulouse (France).
CODED POINTING SYSTEM STAR SENSOR FOR USE ONBOARD A SPINNING SATELLITE [SENSEUR STELLAIRE A MIRE CODEE POUR SATELLITE EN ROTATION]
J. P. Durpaire, J. P. Picault, and J. Breton *In its* Proc. of the 3rd Conf. on Space Optics 1971 p 287-305 In FRENCH (For availability see N72-27435 18-14)

The star tracker attitude control system developed for the French Meteosat satellite is described. The Meteosat satellite is expected to orbit around an axis nearly parallel to that of the earth's poles, and the pointing system will use the pole star as reference star.

N72-27460 Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
TRANSHORIZON SCANNERS [SENSEUR DE TRAVERSEE D'HORIZON]
J. J. Hunzinger *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 307-317 In FRENCH (For availability see N72-27435 18-14)

The principles of a horizon scanner for the attitude control of a geostationary satellite during its transfer orbit phase are reviewed. Its characteristics are presented, including reference system and the infrared (14 to 16 mu) band corresponding to the absorption of the carbon dioxide layer enveloping the earth. The optical and electronic equipment (germanium lens, interference filter, immersed bolometer) are described, and means for the optimization of the bandpass presented. Performance tests were carried out and confirmed the sensor performances predicted by computation. ESRO

N72-27461 Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
STATIC HORIZON SCANNER [SENSEUR D'HORIZON STATIQUE]
F. Desvignes, H. Bacchi, F. X. Doittau (Soc. Anonyme d'Etudes

et Realisations Nucl.), and H. Bourcier (Soc. Anonyme d'Etudes et Realisations Nucl.) *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 319-334 refs In FRENCH; ENGLISH summary (For availability see N72-27435 18-14)

A brief survey is given of the characteristics of instruments to be used for space vehicle attitude control relative to the earth. A static horizon scanner for the control of the Symphonie telecommunication satellite attitude is described. Requirements for this earth horizon sensor, i.e. zero accuracy, output response versus misalignment, and time constant are analyzed. Some of the main problems relating to the Symphonie horizon scanner, functional specifications are presented. ESRO

N72-27462 Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
GROUND SIMULATORS FOR TESTING INFRARED HORIZON SCANNERS [SIMULATEURS DE TERRE POUR L'ESSAI DES SENSEURS D'HORIZON INFRAROUGE] c11
J. J. Hunzinger *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 335-345 In FRENCH (For availability see N72-27435 18-14)

Two facilities for simulating the earth seen from 36,000 km altitude as well as the earth's apparent movement relative to a geostationary satellite were designed for testing the performance characteristics of a static and rotating infrared horizon sensor. A rotating simulator was developed for determination of functional characteristics and accuracy of the transhorizon scanner. A static simulator was developed for determination of static scanner response as a function of the displacement angle. ESRO

N72-27463 Centre National de la Recherche Scientifique, Verrieres-le-Buisson (France). Lab. de Physique Stellaire et Planetaire.
HYPERFREQUENCY EXCITATION GENERATORS [SOURCES EXCITEES PAR HYPERFREQUENCE]
S. Cazes and G. Maruejouls *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 347-351 In FRENCH (For availability see N72-27435 18-14)

An electrodeless discharge monochromator was designed to investigate the Lyman alpha and triplet 01 spectral lines and to eliminate the parasitic lines occurring in electrode discharge lamps. Its operational principles, based on a gas excitation from microwave cavity coupled to a HF generator, are presented. The structural design is described, and performance characteristics such as spectral purity, Lyman flux, and aging are discussed. The use of a HF generator for precise calibration at specific wavelength is emphasized. ESRO

N72-27464 Centre National de la Recherche Scientifique, Verrieres-le-Buisson (France). Service de Technologie Spatiale.
ULTRAVIOLET FLUORESCENCE OF SINGLE CRYSTALS: APPLICATION TO CONTINUOUS RADIATION [FLUORESCENCE U.V. DES MONOCRISTAUX: APPLICATION AUX SOURCES A FOND CONTINU]
A. Rouscilles *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 353-359 In FRENCH (For availability see N72-27435 18-14)

Some luminescent materials were studied in order to select photoluminescent materials with an efficient absorption in the 2500 to 3500 A range and transparent in the near and mean ultraviolet range. Hydrogen discharge sources with lithium fluoride windows emitting the Lyman alpha (1216 A) line which excites the photoluminescence of studied materials is described. Its operational principles are presented, and its structural design and characteristics are detailed. ESRO

N72-27465 Centre National de la Recherche Scientifique, Marseilles (France). Lab. de Technologie optique.
DIRECTIVE DIFFUSERS [DIFFUSEURS DIRECTIFS]
M. Duban *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 361-371 In FRENCH; ENGLISH summary (For availability see N72-27435 18-14)

The design and manufacturing procedures for diffusers formed by 3 mm diameter spherical concave impressions molded in plastic support and treated with A1-MgF2 coating for use in the ultraviolet range were studied. The fundamental geometrical principles governing the use of directive diffusers are discussed. Some applications such as the measurement of the reflectivity of mirrors of any focal length are considered. ESRO

N72-27466 Centre National d'Etudes Spatiales, Toulouse (France).
CHOICE OF PARAMETERS FOR THE METEOSAT RADIOMETER [CHOIX DES PARAMETRES DE PRISES DE VUES POUR LE RADIOMETRE DE METEOSAT]
J. Breton *In its* Proc. of the 3rd Conf. on Space Optics 1971 p 373-400 In FRENCH (For availability see N72-27435 18-14)

The mission specifications for the Meteosat satellite were analyzed, and the parameters relating to the satellite and the radiometer were chosen. The parameters, which include detector dimensions and wavelength range, diameter of input optics, etc., are discussed. Sources of errors, such as detector noise and transfer function variations, are analyzed to minimize the errors in luminance measurements. It is concluded that the optimal parameters are 2,800 cycles/radian for the passband, 400 mm for the optics diameter, and 13.5 to 0.00001 radians as angular dimension. ESRO

N72-27467 Centre National de la Recherche Scientifique, Bellevue (France).
ONBOARD MECHANICAL SCANNING INFRARED RADIOMETER FOR THE 10.5 TO 12.5 MICRON RANGE [RADIOMETRE INFRA-ROUGE AEROPORTE A BALAYAGE MECANIQUE DANS LA GAMME 10,5 A 12,5 MICRONS]
J. L. Monge and F. Sirou *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 401-423 In FRENCH (For availability see N72-27435 18-14)

An infrared camera is described for measuring the terrestrial radiation emissivity from onboard an aircraft in order to select the optimum wavelength range for mapping the terrestrial cloud cover by means of the Meteosat radiometer. The camera scanning system is explained. Criteria for selecting the radiometer wavelength range and structural design are evaluated. The performance of the radiometer as well as sources of error and calibration methods are discussed. Aircraft flights were carried out to test and adjust the complete equipment. ESRO

N72-27468 Engins Matra, Velizy (France).
THE METEOSAT RADIOMETER [LE RADIOMETRE METEOSAT]
A. Peraldi *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 425-437 In FRENCH (For availability see N72-27435 18-14)

A study was carried out on the radiometer onboard the Meteosat satellite for scanning the terrestrial cloud cover and for establishment of wind variation charts. The radiometer configuration characteristics are presented. The equipment is analyzed including a Richey-Chretien telescope, electromechanical systems for image scanning and readjustment in orbit, infrared detectors, photodiodes (visible radiation detectors) and detector subassemblies (readjustement and electronic equipment), as well as the radiometer cooling system. ESRO

N72-27469 Centre National d'Etudes Spatiales, Bretigny-sur-Orge (France).
PREPROCESSING OF METEOSAT IMAGES: MEASUREMENT OF THE GEOMETRIC QUALITY OF THE IMAGE [LE PRETRAITEMENT DES IMAGES DE METEOSAT: MESURE DE LA QUALITE GEOMETRIQUE DE L'IMAGE]
L. Bergeron *In its* Proc. of the 3rd Conf. on Space Optics 1971 p 439-468 In FRENCH (For availability see N72-27435 18-14)

The relation between small displacements or virtual satellite rotations and the geometric quality of an image is presented,

and the maximum permissible perturbations of the satellite vs the quality of a given rough image are discussed. The geometric quality of an image depends on the satellite position and attitude, the synchronization of sampling measurement with the satellite rotation with regard to the earth and on the clamping and displacements of the telescope relative to the satellite body. A computer technique for the preprocessing and ground correction of the image geometry based on an algorithm for attitude restitution of the telescope is described. ESRO

N72-27470 Centre National de la Recherche Scientifique, Verrieres-le-Buisson (France). Service de technologie spatiale.
OPTIMIZATION OF IMAGE QUALITY BY ANALOG COMPUTATION [AMELIORATION DE LA QUALITE DES IMAGES PAR CALCUL ANALOGIQUE]
M. Billon and P. Balaskovic *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 469-480 In FRENCH (For availability see N72-27435 18-14)

The resolution limit of images is defined by the dimension of the image spot corresponding to a point source. This spot depends on the aberration and diffraction of the optical system. A mathematical model was developed for the computation of the illumination at a point knowing the intensity distribution around it. Crude experimental trials resulting in a gain factor of three for the resolution suggest that it may be possible to achieve a gain factor of ten. ESRO

N72-27471# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
REPORT ON TESTS ON THE BERTIN FLUIDIC GYROSCOPE CARRIED OUT AT THE CEV/LEA [COMPTE RENDU D'ESSAIS DU GYROMETRE FLUIDIQUE BERTIN (ESSAIS EFFECTUES AU CEV/LEA)]
29 Mar. 1972 45 p In FRENCH
(Contract DRME-70/126)
(LRBA-E204-PV-5) Avail: NTIS HC $4.25

Performance tests were carried out on two vortex-type gyroscopes with a high gain three-step fluidic amplifier as output. The main characteristics of a gyroscope were evaluated as a function of the power supply conditions and analyzed separately from the results of these tests. ESRO

N72-27472# Saab Aircraft Co., Linkoping (Sweden).
A PHOTOGRAMMETRIC THREE-POINT METHOD FOR ANALYSING THE MOTION OF MOVING OBJECTS
Kaare Moen 1972 37 p refs
(SAAB-TN-68) Avail: NTIS HC $4.00

Three of the six independent quantities necessary to describe the position of the camera in space have been chosen to specify the position of the optical center (focus) and the other three to specify the attitude angles (Euler angles). The attitude angles of the camera are determined by means of iterative angle computations with subsequent film coordinate transformation until convergence is achieved. Using the transformed film coordinates, the focal length of the camera lens and the positional coordinates of the points on the ground, the position of camera is computed in relation to the origin of the ground-based system in which the attitude angles were computed. As this system is usually an auxiliary system, further transformations are required in order to obtain the positional coordinates and attitude angles of the camera in the desired system. Knowing the positional coordinates of the camera and the mounting angles in the aircraft reference system it is then possible to compute the attitude angles of the aircraft and the position of its mean center of gravity. These quantities, which are instantaneous values for the time at which the frame was exposed, are evaluated for all the frames of interest. Using the camera frame rate, the instantaneous values are joined together into functions of time. The final phase of the motion analysis consists of digital low-pass filtering and differentiation and transformation to give the angles of attack and sideslip, heading angle, flight path angle and translational and angular velocities of the aircraft. Author (ESRO)

N72-27473# Accumetrics Corp., Cambridge, Mass.
DEVELOPMENT OF A SENSITIVE TRIAXIAL PIEZOELECTRIC ACCELEROMETER Final Report, 6 May 1968 - 3 May 1971
Donald H. Fryklund 1 Jun. 1971 52 p
(Contract F19628-68-C-0358; AF Proj. 6690; AF Proj. 8605)
(AD-739202; AC-144; AFCRL-72-0033) Avail: NTIS CSCL 04/1

In an effort to extend the upper limit of the falling sphere type of upper atmospheric density measuring system a program was conducted to develop accelerometry having sensitivity in the range 10 to the -8th power to 10 to the -2 power. A potentially low-cost triaxal accelerometer was developed and fabricated using highly loaded piezoelectric bimorphs. To match the bimorphs into the electrical system, and to amplify their low signal voltages, extremely low-noise solid state electronic circuitry had to be developed. Because of the high sensitivity of the sensors used, particular care had to be taken in seismically isolating the test aparatus to reduce input accelerations due to building noise, traffic, wind, etc. Author (GRA)

N72-27474# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALIBRATING PR 30/6 THERMOCOUPLES UP TO 1800 C
B. K. Bragin and V. L. Maksimov 18 Dec. 1971 15 p refs Transl. into ENGLISH from tr., Metrologicheskie inst. (USSR), v. 105, no. 165, 1965 p 167-170
(AF Proj. 6112)
(AD-738748; FTD-MT-24-1616-71) Avail: NTIS CSCL 14/2

A method is proposed for the calibration of thermocouples at the melting point of platinum by the small batch method. The method of calibration is described, the reproducibility of the point of platinum melting is estimated, and the data is compared with those of a standard calibration and the typical calibration of the firm Degussa and NBS. Author (GRA)

N72-27475# Aerospace Corp., El Segundo, Calif. Lab. Operations.
CONSTRUCTION AND OPERATION OF AN IMPROVED ICE CALORIMETER Technical Report, Jan. 1964 - Jun. 1966
Elfreda T. Chang, Nev A. Gokcen, and Charles D. Robinson 15 Mar. 1972 38 p refs
(Contract F04701-71-C-0172)
(AD-739186; TR-0172(2210-10)-2; SAMSO-TR-72-54) Avail: NTIS CSCL 14/2

Construction, calibration, and operation of an improved Bunsen-type calorimeter are described in detail. Author (GRA)

N72-27476# Texas A&M Univ., College Station. Dept. of Industrial Engineering.
DIGITAL FLUIDIC SYSTEMS LABORATORY PROPOSAL M.S. Thesis
John Lewis Palman, Jr. 1971 71 p refs Sponsored by Army
(AD-739430) Avail: NTIS CSCL 13/7

The document presents a comprehensive analysis of the equipment that is necessary to set up a digital fluidic systems laboratory. The advantages offered by this young technology are discussed and terminology used in fluidics is defined. An attempt is made to introduce the field of fluidics to those first investigating it. The final proposal consists of the equipment necessary to set up a digital fluidics laboratory, together with circuit experiments that illustrate possible applications of fluidics to control system design. Author (GRA)

N72-27477# Texas A&M Univ., College Station. Dept. of Industrial Engineering.
A COMPARISON OF VISUAL AND AUDITORY DISPLAYS AS CHECK OUT INDICATORS M.S. Thesis
Nick L. Brixius 1971 36 p refs
(AD-739475) Avail: NTIS CSCL 14/2

An experiment comparing visual and auditory displays when used as dynamic tri-level condition displays in electronic equipment checkout procedures is reported. The auditory displays equaled or surpassed the visual displays in terms of time required for checkout and were judged to be advantageous in certain maintenance or test applications. The results are applicable to depot maintenance procedures. Author

N72-27478# Battelle Memorial Inst., Columbus, Ohio.
USE OF KRYPTONATES AS A SURFACE TEMPERATURE MEASUREMENT TECHNIQUE Final Report
Robert L. Ritzman and Merwyn R. Vanderlind 25 Oct. 1971 24 p refs
(Contract DASA01-71-C-0041)
(AD-739372; DNA-2836F) Avail: NTIS CSCL 14/2

The purpose of the research was to determine the value of certain parameters that would lead to the successful use of kryptonates as passive temperature sensors when heating times are on the order of 10 to the (-8)th power to 10 to the (-9)th power seconds. The nonlinear diffusion of gas in solids, which is the basis of the technique, is not well understood. Therefore, the approach employed was empirical in nature. This approach was intended to determine workable values of impregnation gas pressure, time, and temperature. Kryptonates were exposed to a high intensity sungun and an electron beam. Sungun data resulted in temperature measurements 4 to 8 percent too low, while electron beam data were as much as 30 percent too low, as compared with conventional temperature measurement methods. Author (GRA)

N72-27479# Aerospace Corp., El Segundo, Calif.
A NEW TECHNIQUE FOR ESTIMATING THE MODULATION TRANSFER FUNCTION OF AN IMAGING SYSTEM FROM ITS EDGE RESPONSE Technical Report, Jan. 1970 - Jul. 1971
Patrick L. Smith 15 Oct. 1971 24 p refs
(Contract F04701-71-C-0172)
(AD-739550; TR-0172(2441-02-)-4; SAMSO-TR-72-66) Avail: NTIS CSCL 14/5

The optical transfer function (OTF) is the name given to the two-dimensional Fourier transform of an imaging system's impulse response or point spread function, where a point source in the field of view is an impulse. The modulation transfer function (MTF) is the modulus of OTF. A cross section of the MTF can be estimated from a noisy knife-edge image recorded in the film. An MTF estimate is useful for system performance analysis (if the film effects are backed out) and image enhancement. The new method for estimating the MTF proposed in this report has two major advantages over other methods reported in the literature: the averaging effects of the microdensitometer aperture and the nonlinear film characteristics can be included in the regression equation, and the phase errors between successive edge scans are estimated. Author (GRA)

N72-27480# Bissett-Berman Corp., San Diego, Calif.
AUTOMATIC CAPACITANCE MEASURING SYSTEM Final Report, Dec. 1968 - Feb. 1971
Roger A. Hala Aug. 1971 64 p
(Contract F33615-69-C-1298; AF Proj. 1347)
(AD-739556; AFFDL-TR-71-101) Avail: NTIS CSCL 14/2

The report describes the development of an automatic capacitance measurement system. The system was specifically designed to be compatible with a capacitive strain gage working in ambient temperatures up to 1500 F. The progression of the development yielded a system capable of measuring three terminal capacitors at a distance of up to 150 feet. The system measures capacitances from 10 to 30 pf and automatically balances the loss component. Four frequencies of operation are selectable for system operation. The outputs of the system are a dc voltage of 50 mv/pf and a digital indication of capacitance. Author (GRA)

N72-27481# California Univ., San Diego. Inst. of Geophysics and Planetary Physics.
BROAD BAND ACCELEROMETERS AND THEIR DEPLOYMENT FOR SEISMIC STUDIES Final Report
Barry Block 22 Feb. 1972 154 p refs
(Contract F44620-71-C-0128; ARPA Order 1618)
(AD-739975; AFOSR-72-0608TR) Avail: NTIS CSCL 14/2

The vertical accelerometers were used to make a six month (January to July 1971) data collection run which is being used to determine detection thresholds and azimuthal dependences. This run was made at a surface site at Camp Elliott, San Diego. The horizontal accelerometers were completed and placed in operation and data gathered simultaneously with the vertical accelerometers for several months at a surface site at Camp Elliott, San Diego. Both a vertical and horizontal were used in a mine test at 5300 and 6700 feet. The results showed that the major improvement came in the horizontal data which showed no diurnal effect as is seen in the surface data. Author (GRA)

N72-27482# Photometrics, Inc., Lexington, Mass.
PRECISE MEASUREMENT, REDUCTION AND DISPLAY OF SPECTROPHOTOMETRIC DATA Final Report, 1 May 1970 - 30 Jun. 1971
Christian A. Trowbridge, John C. Bowman, and Irving L. Kofsky 31 Jul. 1971 34 p refs
(Contract F19628-70-C-0260; AF Proj. 8608)
(AD-739868; PhM-106-71; AFCRL-71-0420) Avail: NTIS CSCL 03/2

Microdensitometric film reduction, analysis, and display techniques were applied to solar surface radiance and stellar spectral data. Hydrogen-alpha photographs of a solar flare event were converted to isophote contour plots, from which brightness solids were measured by planimetry, and radiance profiles read along selected lines. Solar granulation was observed isophotometrically with two different types of microdensitometric scanner-printer, and density histograms of the granular structure measured with the aid of a pulse height analyzer. Photographically recorded spectra of the core and outer envelope plasmas of a star were put on magnetic tape in position register for differencing by digital computer. Author (GRA)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication; friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N72-27483 National Lending Library for Science and Technology, Boston Spa (England).
DETERMINATION OF LIMITING DRAWING RATIO USING DRAWING FORCE AND TEAR STRENGTH: APPLICATION TO STAINLESS STEEL SHEET
W. Kueppers and K. Schmitz 29 Feb. 1972 8 p refs Transl. into ENGLISH from Blech Rohre Profile (West Germany), 1971 p 356-359 In GERMAN and ENGLISH
(NLL-Trans-746-1152-(9022.401)) Avail: Natl. Lending Library, Boston Sap, Engl.: 1 NLL photocopy coupon

Shaping processes for cylindrical cups are discussed in terms of deep-drawing, and stretch-forming behavior. The methods considered for determining deep-drawing response are by subjecting a number of blanks to deep-drawing, and establishing the diameter that can be deep-drawn without failure; and from drawing force and tear strength. Tear strength and limiting drawing ratios are graphed for austenitic steel, werkstoff 4319; ferritic steel, werkstoff 4016; and austenitic steel, werkstoff 4301. F.O.S.

N72-27484* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ADJUSTABLE SUPPORT Patent
Thomas W. Andrews, inventor (to NASA) Issued 13 Jun. 1972 4 p Filed 31 Jul. 1970 Supersedes N72-15466 (10 - 06, p 0777) Sponsored by NASA
(NASA-Case-NPO-10721; US-Patent-3,669,393; US-Patent-Appl-SN-59968; US-Patent-Class-248-188.4) Avail: US Patent Office CSCL 13I

An adjustable support by which the distance at which a member is supported with respect to a base may be altered, is readily accessible for adjustment at a point remote from the supported member with respect to the base. It includes a junction with the supported member which is capable of limited universal movement to accommodate misalignment of the supported member with respect to the base.
Official Gazette of the U.S. Patent Office

N72-27485* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MICROCIRCUIT NEGATIVE CUTTER Patent
Douglas W. Whipple and Earl R. Blymiller, inventor (to NASA) Issued 13 Jun. 1972 5 p Filed 4 Aug. 1970 Supersedes N72-14497 (10 - 05, p 0639)
(NASA-Case-XLA-09843; US-Patent-3,668,956; US-Patent-Appl-SN-60876; US-Patent-Class-83-8; US-Patent-Class-83-522; US-Patent-Class-83-562; US-Patent-Class-83-563; US-Patent-Class-83-588) Avail: US Patent Office CSCL 13I

A manually operated X-Y coordinate cutter for making surface cuts with great accuracy in all three cutting dimensions is reported. The cutting blade is rotated to cut in the X or Y direction and adjusted, in combination with a roller which contacts the work, to make cuts of uniform depth in the work. The roller and cutting blade are spring-mounted to ride smoothly over surface irregularities while maintaining a constant cutting depth. A pattern, placed between a translucent cutting surface and a translucent workpiece, is illuminated by a light box for use as a rough guide during cutting operations. X-Y dimensions of the cuts are laid out from a reference point on the pattern by positioning the cutting blade with verniers.
Official Gazette of the U.S. Patent Office

N72-27486* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPARATUS AND METHOD FOR APPLYING PROTECTIVE COATINGS Patent Application
Harry H. Becker and Hans-Juergen C. Blume, inventors (to NASA) Filed 27 Jun. 1972 57 p refs
(NASA-Case-LAR-10362-1; US-Patent-Appl-SN-266772) HC $3.00 CSCL 11C

An apparatus and method for applying protective coatings are described. The coatings of a noble metal on glass or quartz substrates to protect optical surfaces from infrared radiation and high temperatures are discussed. Examples include the use of undercoatings of niobium, tantalum, or vanadium. The outer coatings are composed of gold, platinum, silver, or copper. The application of multiple protective metal coatings on a glass substrate under the same vacuum is reported. NASA

N72-27487 National Lending Library for Science and Technology, Boston Spa (England).
SAFETY IN THE RUNNING OF PLANT PRODUCING AND USING OXYGEN
W. Wessing 11 May 1972 20 p Transl. into ENGLISH from Maschinenschaden (Munich), v. 34, Aug. 1961 p 97-107
(NLL-CE-Trans-5849-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Industrial practices for the production of oxygen are discussed. The protection measures necessary for avoiding accidents and resulting damage are considered. Selection and training of operating staff and the individual protective equipment for the staff, layout of working area, dangerous impurities which may be present in the air, and dangers created by the presence of grease and oils are examined. The insulating materials, requirements for piping, valves and linings, and the equipment for monitoring operation and maintenance of the plant are described. Author

N72-27488 National Lending Library for Science and Technology, Boston Spa (England).
NEW METHOD OF RAPID ELECTROLYTIC SURFACE POLISHING AND ITS METALLOGRAPHIC APPLICATIONS
P. A. Jacquet 20 Apr. 1972 9 p refs Transl. into ENGLISH from Compt. Rend. (Paris), v. 243, 17 Dec. 1956 p 20682071 In FRENCH and ENGLISH
(NLL-T-1514-(9022.305)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A very simple device comprising a cathode surrounded by spongy insulating materials permits local or total polishing of specimens of metals and commercial alloys. The rapidity with which a high degree of polish is obtained justifies generalization of this technique, intended originally for non-destructive metallographic examinations of large pieces. Author

N72-27489 National Lending Library for Science and Technology, Boston Spa (England).
THE THEORY OF ROTARY EXTRUSION OF SHELLS OF REVOLUTION
V. F. Barkaya and S. E. Rokotyan [1972] 9 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), no. 1, 1972 p 96-99
(NLL-M-21379-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The results are presented of a theoretical investigation of the force parameters in the rotary extrusion of thin walled shells of revolution. Two conditional zones in the plastic deformation zone are considered - the zone of rolling reduction and the shear zone. Calculating formulae are obtained for tangential and normal stresses. Curves of normal contact stresses are presented for different types of rotary extrusion. Author

N72-27490 National Lending Library for Science and Technology, Boston Spa (England).
CEMENTATION IN ELECTRICALLY CONDUCTIVE FLUIDIZED BED
V. I. Muravev, V. P. Kurbatov et al 4 Apr. 1972 7 p Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 9, 1971 p 61-63 In RUSSIAN and ENGLISH
(NLL-Trans-746-1149-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The cementation in a fluidized bed containing graphite particles with the granule dimension of 0.2 to 0.4 mm was investigated. Heating was accomplished by the transmission of an alternating current across a layer 150 times 150 times 400 mm. The current was fed to the fluidized bed by two graphite electrodes 25 mm in diameter, lowered to a depth of 350 mm. The working voltage was 96 V. The effect on cementation of the temperature of the fluidized bed, the duration of holding, the system of fluidization, the gaseous atmosphere in the layer and the electric current, passed across the layer during its heating, was studied. Author

N72-27491 Welding Inst., Cambridge (England).
IMPROVING WELDED PRODUCT DESIGN. VOLUME 1: PAPERS Conference Proceedings
1971 161 p refs Conf. held 16-18 Nov. 1971
Copyright. Avail: Issuing Activity

The papers presented at the conference on improving product design are reported. The papers are grouped under the following topics: design network, relevant material properties, fatigue behavior, static strength of welded structures, and training for welding design. For individual titles, see N72-27492 through N72-27510.

N72-27492 Whessoe Ltd., Darlington (England).
INFLUENCE OF DESIGN CRITERIA ON MATERIAL COSTS Conference Paper No. 1
S. Nicholson and R. Blenkin *In* Welding Inst. Improving Welded Prod. Design, Vol. 1 1971 p 1-13 refs (For availability see N72-27491 18-15)
Copyright.

Design parameters influencing material selection include strength criteria and factors of safety, joint factor and the related question of inspection, and criteria to avoid fracture in service or during pressure testing. Design codes for pressure vessels constructed in carbon and carbon-manganese steel are compared with particular emphasis on parameters such as those listed which determine steel quality and hence overall cost. Client requirements additional to those laid down in design codes are also considered. The need for a rationalization of design approach to avoid the use of unnecessarily expensive material and achieve optimum design economy is illustrated by reference to identical fabrications designed to meet the requirements of several alternative codes. Author

N72-27493 Central Electricity Generating Board, Berkeley (England). Structural Materials and Dynamics.
THE ROLE OF RESEARCH AND DEVELOPMENT WITH PARTICULAR REFERENCE TO HIGH TEMPERATURE WELDED STRUCTURES Conference Paper No. 2
B. J. L. Darlaston *In* Welding Inst. Improving Welded Prod. Design, Vol. 1 1971 p 14-17 refs (For availability see N72-27491 18-15)
Copyright.

The role of research and development (R and D) in the field of welded structures is discussed with particular reference to high temperature structures. Analytical techniques, experimental work, the use of data, and finally the formulation of design methods are described. The situation is summarized by setting out the objectives for a research program on high temperature welded structures. The relationship between the R and D role and the needs of the designer is emphasised. Author

N72-27494 Welding Inst., Cambridge (England).
SOME METALLURGICAL FACTORS TO BE CONSIDERED FOR THE DESIGN AND FABRICATION OF EQUIPMENT EXPOSED TO HYDROGEN ENVIRONMENTS Conference Paper No. 3 **c17**
H. T. Richardson (Bechtel Intern. Ltd.) *In its* Improving Welded Prod. Design, Vol. 1 1971 p 18-26 refs (For availability see N72-27491 18-15)
Copyright.

The mechanisms commonly attributed to hydrogen embrittlement and carbide disintegration phenomena are described. Material selections and welding procedures should be evaluated to give notch ductility and maximum strength levels of approximately 785 N/sq mm ultimate and 637 N/sq mm yield strength (Rc 22). The use of Rc 22 as a workshop test is based on long-term failure data in various hydrogen environments. Postweld heat treatment increases the resistance of materials to hydrogen when carried out below A sub c1, and the response of various welding procedures and consumables should be checked to ensure proper heat treatment cycles. Author

N72-27495 Welding Inst., Cambridge (England).
DESIGN TO AVOID BRITTLE FRACTURE IN WELDED STRUCTURES Conference Paper No. 4
G. L. Archer *In its* Improving Welded Prod. Design, Vol. 1 1971 p 27-34 refs (For availability see N72-27491 18-15)
Copyright.

The paper is aimed at informing, in straightforward terms, the designer of ordinary welded structures such as cranes, bridges, crushers, buildings, etc., of the possible approaches to the problem of preventing brittle fracture initiation. The nature of the problem is analyzed in terms of service failures and the lessons learned are used in justifying design approaches. After a brief consideration of test techniques the application of test results to design is discussed in conjunction with the methods proposed by the codes. Finally, the application of fracture mechanics and the necessity for a data bank to formulate a future approach are discussed. Author

N72-27496 Gas Council, London (England).
RELEVANCE OF HEAT-AFFECTED ZONE TOUGHNESS TO MATERIAL SELECTION FOR PRESSURE VESSELS Conference Paper No.5 **c32**
G. D. Fearnehough *In* Welding Inst. Improving Welded Prod. Design, Vol. 1 1971 p 35-44 refs (For availability see N72-27491 18-15)
Copyright.

This paper details investigations into the toughness of the heat-affected zone (HAZ) of a stress-relieved, automatic submerged-arc, pressure vessel seam weld in 50 and 75 mm plate BS 1501-224-LT50. These investigations were designed to compare the toughness levels in various regions of the HAZ as assessed by crack opening displacement (COD) tests and the results of conventional Charpy tests on both HAZ and parent plate. The results show that there is no significant influence of notch position within the HAZ on either the COD or Charpy tests. The COD results were used to derive recommended minimum operating temperatures for these weldments on the basis of fracture mechanics estimates of defect tolerance. The temperatures (which correspond to the tolerance of large defects) are in reasonable agreement with the recommendations of BS 1515, Appendix C (Rev) based on data from wide plate tests employing small defects. It is concluded that the code is sufficiently conservative in providing tolerance for considerably larger defects than used in the wide plate test. Author

N72-27497 Cranfield Inst. of Technology (England).
THE RELEVANCE OF QUALITY CONTROL TESTS IN WELDED DESIGN Conference Paper No. 6
J. E. M. Jubb and M. L. Drury *In* Welding Inst. Improving Welded Prod. Design, Vol. 1 1971 p 45-51 refs Supported in part by the Sci. Res. Council (For availability see N72-27491 18-15)
Copyright.

Quality control tests are included in the majority of material specifications and the relevance of some of these tests carried out by the material producer to the problems of the designer is examined both for production and service conditions. For the latter the more typical modes of failure of a welded fabrication are included and it is found that the quality control tests generally give little help to the designer. Where there is a requirement for a tensile and a bend specimen on the same piece of material the authors question the need to make a double assessment of ductility. A strain measurement in a tensile test before necking could eliminate the need for a bend test and be more relevant than the determination of elongation, the percentage change of the gauge length in the broken tensile specimen. At best the value of the elongation is a quality control check to be used on a comparable basis, but a change ir the more important stress values should indicate unsatisfactory material as readily as a sudden change in elongation. Author

N72-27498 Welding Inst., Cambridge (England).
THE PROPOSED NEW CODE OF PRACTICE FOR THE DESIGN OF WELDED STRUCTURES SUBJECT TO FATIGUE LOADING Conference Paper No. 7
S. Wise (Railway Tech. Centre), T. R. Gurney, and S. J. Maddox *In its* Improving Welded Prod. Design, Vol. 1 1971 p 52-61 refs (For availability see N72-27491 18-15)
Copyright.

The general form of a proposed code of practice for designing welded structures subjected to fatigue loading is outlined, based on a statistical analysis of tensile loading data including uniaxial loading and unidirectional bending available since 1950. Topics discussed include: choice of design stresses, cumulative damage, methods for improving strength of welds, acceptance fatigue tests, and repair of welded structures. F.O.S.

N72-27499 Gas Council, London (England). Experimental Services Group.
FATIGUE CONSIDERATIONS IN THE DESIGN OF PIPELINES Conference Paper No. 8
D. P. James, D. C. Edward, and J. R. Christian *In* Welding Inst. Improving Welded Prod. Design, Vol. 1 1971 p 62-72 refs (For availability see N72-27491 18-15)
Copyright.

A design method is described which enables the fatigue life of a seam-welded pipeline to be estimated under conditions of fluctuating pressure. A safe life can be calculated with a specified degree of certainty, so that a suitably low failure rate is not exceeded. A design method is described for individual pipe lengths whereby the stress state near the seam weld can be predicted from geometry measurements. The fatigue life is then estimated from fatigue characteristic curves derived from pulsating-tension tests upon small welded specimens. Experimental results are presented for pressure cycling tests upon pipe lengths and rings selected with good and poor geometry. The tests were conducted to substantiate the above method of prediction and the experimental lives exceeded those predicted by factors between 3 and 7. This discrepancy is larger than expected but, as well as being conservative, it is considered small enough to be acceptable for the design method. It is hoped that further work, which is now progressing, will explain and suggest ways of minimizing this difference. A statistical method is outlined for predicting the failure rate of a pipeline at a specified probability level. This is based upon geometric measurements made upon several pipe lengths randomly selected from the batch to be used. Author

N72-27500 Cambridge Univ. (England).
EFFECT OF WELDING ON COMPRESSION ELEMENTS Conference Paper No. 9 c32
J. B. Dwight *In* Welding Inst. Improving Welded Prod. Design, Vol. 1 1971 p 73-84 refs (For availability see N72-27491 18-15)
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An approximate method for estimating the residual stresses caused by longitudinal weld shrinkage is described. Transverse residual stresses and welding distortions are also discussed. The effects of residual stress and initial crookedness on column buckling performance are then considered. Finally, there is a discussion of the effects of residual stress and out-of-flatness on the buckling of plates. Author

N72-27501 Imperial Coll. of Science and Technology, London (England).
BASIS OF DESIGN FOR FILLET-WELDED JOINTS UNDER STATIC LOADING Conference Paper No. 10 c32
P. J. Clark *In* Welding Inst. Improving Welded Prod. Design, Vol. 1 1971 p 85-96 refs (For availability see N72-27491 18-15)
Copyright.

The paper refers to recent research and some current foreign codes to present the designer with better data for the estimation of the strength and performance of fillet-welded joints from the current British Codes. The limitations of theoretical stress analysis of fillet welds and the experimental bases for design formulae are summarized, and the importance of the load-strain characteristic for the weld is emphasized. Recent research at Imperial College leading towards a better assessment of the strength of long joints and groups of fillet welds under eccentric loading is reported. Author

N72-27502 Welding Inst., Cambridge (England).
TRAINING FOR WELDING DESIGN Conference Paper No. 11
R. P. Newman *In its* Improving Welded Prod. Design, Vol. 1 1971 p 97-104 refs (For availability see N72-27491 18-15)
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Training requirements for designing welds are discussed in terms of answers to a questionnaire by the Welding Institute. Topics discussed include: basic engineering training, welding technology in engineering courses, types of training, and teacher training. A syllabus for a welding design course is included. F.O.S.

N72-27503 Hawker Siddeley Dynamics, Ltd., Hatfield (England).
EXPLOITATION OF HIGH VOLTAGE ELECTRON-BEAM WELDING Conference Paper No. 12
J. V. Birnie *In* Welding Inst. Improving Welded Prod. Design, Vol. 1 1971 p 105-112 refs (For availability see N72-27491 18-15)
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The benefits obtained from using high voltage electron-beam welding on product design and several case histories of production applications are presented. Additional information is included on weld properties followed by a few observations on weld quality control. The latest developments in electron-beam machines are reviewed including higher powered guns, horizontally mounted guns, and beam deflection techniques, and how these contribute to production welding. Author

N72-27504 Welding Inst., Cambridge (England).
SUCCESSFUL AND PROFITABLE ELECTRON-BEAM WELDING ON SMALL COMPONENTS Conference Paper No. 13
R. E. Trillwood (Wentgate Engr. Ltd.) *In its* Improving Welded Prod. Design, Vol. 1 1971 p 113-118 refs (For availability see N72-27491 18-15)
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The design requirements are described for components which are to be electron beam welded. The main consideration for profitable electron beam welding (EBW) is that the components are designed specifically for this purpose. The advantages of EBW are discussed along with the requirements of intimate contact, and metallurgical compatibility between the materials being welded. F.O.S.

N72-27505 Babcock and Wilcox Ltd., London (England).
HIGH INTEGRITY TUBE-TO-TUBEPLATE BORE WELDS Conference Paper No. 14
A. J. Perrin and A. Speirs *In* Welding Inst. Improving Welded Prod. Design, Vol. 1 1971 p 119-127 (For availability see N72-27491 18-15)
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The automatic welding processes developed and applied to the tube-to-tubeplate sodium cooling system in the Prototype Fast Reactor are described. The weld requirements for meeting the safety and operating standards are discussed along with the quality controls for obtaining high integrity welds. F.O.S.

N72-27506 Welding Inst., Cambridge (England).
HEAT EXCHANGER TUBE-TO-TUBEPLATE JOINTS FOR THIN WALLED TUBES Conference Paper No. 15
F. P. Hahn (Imp. Chem. Ind. Ltd. Agr. Div.) *In* Welding Inst. Improving Welded Prod. Design, Vol. 1 1971 p 128-130 (For availability see N72-27491 18-15)
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The reliability of methods for welding tube-to-tubeplate in heat exchangers is discussed along with the human factors, and equipment defects that result in inadequate welds for thin walled tubes. It is concluded that the inability to avoid the occasional isolated defect in welds, or to detect them before a unit goes into service, presents a definite limitation to the designer. F.O.S.

N72-27507 Welding Research Inst. (VUS), Bratislava (Czechoslovakia). Dept. of Resistance Welding.
RESISTANCE PROJECTION WELDING OF LARGE CROSS-SECTIONS AND MACHINE COMPONENT DESIGN Conference Paper No. 19
M. Janota and R. Minarik *In* Welding Inst. Improving Welded Prod. Design, Vol. 1 1971 p 131-135 refs (For availability

see N72-27491 18-15)
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Resistance welding techniques are discussed along with the principles of joint design, and the mechanical properties of large cross-section welded joints for machine components. It is concluded that the method gives high productivity, and can be used to join a wide range of steels. F.O.S.

N72-27508 Vereinigte Oesterreichische Eisen- und Stahlwerke A.G., Linz (Austria).
IMPROVED DESIGN OF WELDED LD CONVERTERS Conference Paper No. 16
O. Purehringer and F. Wallner *In* Welding Inst. Improving Welded Prod. Design, Vol. 1 1971 p 136-143 (For availability see N72-27491 18-15)
Copyright.

Since the invention of the LD process vessel sizes have increased from 30 to 400 tons. This rise has brought basic problems in design, construction, and material. After describing the main modes of possible failures, i.e. harmful cracks and excessive deformation, the material requirements are analyzed on the basis of stress conditions. For an optimum choice of material these requirements as well as the manufacturing conditions have to be taken into account. For the part of the central vessel carrying the structure for load distribution, a micro-alloyed fine-grained C-Mn steel with high resistance to aging and brittle fracture and optimum weldability is employed. Maximum protection from harmful cracks is therefore achieved. The deformation caused by creep at elevated temperatures, which results from the lower tensile properties of this steel type, is accounted for by a new design concept. The peculiarity of this concept is a statically determinate vessel suspension, the load being distributed by disc suspension. Author

N72-27509 Welding Inst., Cambridge (England).
SOME CASE STUDIES IN WELDED STRUCTURE DESIGN Conference Paper No. 17
D. W. Smith (Mott, Hay, and Anderson) *In* Welding Inst. Improving Welded Prod. Design, Vol. 1 1971 p 144-151 refs (For availability see N72-27491 18-15)
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A series of welded steel structures or members is described, each presenting a particular problem which, after investigation, enabled the designers to learn useful lessons. The principal items are: (1) a high yield steel bowstring girder to carry heavy loads in a power station boiler house roof i.e. problem of stress distribution in a stiff jointed frame; (2) a high yield steel bridge girder i.e. avoidance of brittle fracture without ND steel; (3) bridge box girder fabrication i.e. fatigue effect of tack welds; (4) steel bridge deck i.e. design against fatigue; and (5) tunnel lining i.e. welding in damp conditions. Pointers for further progress are included. Author

N72-27510 Welding Inst., Cambridge (England .
OPTIMUM DETAIL DESIGN BASED UPON STRAIN MEASUREMENTS IN SERVICE Conference Paper No. 18 c32
B. R. Piggott and C. C. Woodley *In its* Improving Welded Prod. Design, Vol. 1 1971 p 152-158 refs (For availability see N72-27491 18-15)
Copyright.

Some of the principles are described which engineers should consider when designing welded structures to withstand dynamic service stresses. It is emphasized that the number of service failures which occur each year could be drastically reduced if designers had a better understanding of the actual stresses their structure encounters in service, and were also aware of the current design data which is available in British Standard specifications and the research literature. The use of strain gauge techniques for determining the actual service stresses in structures is discussed, and the text is illustrated by quoting extracts from actual investigations which have been carried out by The Welding Institute's Design Consultancy Service. Author

N72-27511 Welding Inst., Cambridge (England).
PROCEEDINGS OF THE CONFERENCE ON IMPROVING WELDED PRODUCT DESIGN. VOLUME 2: DISCUSSIONS
1972 44 p refs Conf. held at Cambridge, England, 16-18 Nov. 1971
Copyright. Avail. Issuing Activity

The discussions concerning the papers presented at the conference on improving the design of welded products are reported. Topics discussed include: stress relief of test samples, material properties, fatigue behavior, static strength, training for welding designers, and welding engineer and designer in partnership. F.O.S.

N72-27512 National Lending Library for Science and Technology, Boston Spa (England).
CAPACITIVE METHOD FOR MEASURING THE THICKNESS OF THE METALLIC COATING ON ONE SIDE OF PLASTIC SHEETING
Albert Ott 20 Apr. 1972 8 p Transl. into ENGLISH from Materialpruefung (W. Germany), no. 7, 1967 p 270-272
(NLL-293-(8660.5)) Copyright. Avail: Natl. Lending Library, Boston Spa Engl.: 1 NLL photocopy coupon

The procedure for using two capacitive probes connected in a bridge circuit to measure the thickness of the metallic coating on one side of plastic sheets is described. The method employed is independent of the relative dielectric constant of the plastic sheet. The conditions under which the optimum size of the probe can be used and the measurement circuits are defined. Mathematical model are included to support the theoretical considerations. P.N.F.

N72-27513 National Lending Library for Science and Technology, Boston Spa (England).
SOME REGULARIZATIONS IN PROCESSES OF ABRASIVE WEAR OF THE CARBIDES OF THE TRANSITION METALS
A. Ya. Artamonov and G. A. Bovkun Jun. 1972 7 p refs Transl. into ENGLISH from Tugoplavkie Karbidy (Kiev), 1970 p 217-220
(NLL-RTS-7289) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.60; 2 NLL photocopy coupons

The abrasive wear resistance of carbides of transitior metals is discussed. Methods for determining the wear resistance properties are described. Tables of data are presented to show the hardness and relative wear resistance of refractory compounds. It is shown that for technically pure metals the wear resistance is directly proportional to the hardness and is also associated with the modulus of normal elasticity. The type of electron structure and chemical bond of the elements in the lattices of the refractory compounds are examined with respect to their effect on wear resistance properties of metals. P.N.F.

N72-27514 National Lending Library for Science and Technology, Boston Spa (England).
WELDABILITY OF CAST IRONS: THE USE OF CONTINUOUS COOLING TRANSFORMATION DIAGRAMS
H. Granjon 4 Apr. 1972 17 p refs Transl. into ENGLISH from Soudage Tech. Connexes (France), v. 25, Jan. - Feb. 1971 p 7-15 In FRENCH and ENGLISH
(NLL-LTI-746-1053-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The application of continuous transformation diagrams (TRC diagrams) for determining the properties of various metals after welding is discussed. The microstructure of graphite cast iron following rapid heating during the welding process is described. The conclusions derived from the application of the TRC diagram are: (1) the inertia of the flake graphite on heating and the relative slowness of diffusion of spheroidal graphite favor low energy welding processes, (2) post-heating techniques are satisfactory for welded cast iron, and (3) slow welding procedures are desirable to prevent martensite formation in cast irons. Author

N72-27515*# Hughes Aircraft Co., Culver City, Calif. Component and Materials Lab.
FEASIBILITY OF DEVELOPING LSI MICROCIRCUIT RELIABILITY PREDICTION MODELS Final Report
C. M. Ryerson Jan. 1972 93 p refs
(Contract NAS8-27386)
(NASA-CR-123714; P72-24) Avail: NTIS HC $6.75 CSCL 14D

In the proposed modeling approach, when any of the essential key factors are not known initially, they can be approximated in various ways with a known impact on the accuracy of the final predictions. For example, on any program where reliability predictions are started at interim states of project completion, a-priori approximate estimates of the key factors are established for making preliminary predictions. Later these are refined for greater accuracy as subsequent program information of a more definitive nature becomes available. Specific steps to develop, validate and verify these new models are described. Author

N72-27516*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESEARCH ACHIEVEMENTS REVIEW, VOLUME 4. QUALITY AND RELIABILITY ASSURANCE RESEARCH AT MSFC
30 May 1972 69 p refs
(NASA-TM-X-64666; Rept-5) Avail: NTIS HC $5.50 CSCL 14D

Technological advancements in the field of reliability engineering and quality assurance are reviewed along with their potentials and limitations in aerospace applications. For individual titles, see N72-27517 through N72-27521.

N72-27517* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ADVANCED RADIOGRAPHIC IMAGING TECHNIQUES
J. B. Beal *In its* Res. Achievements Rev. 30 May 1972 p 1-20 refs (For availability see N72-27516 18-15)
CSCL 14D

The nature and operational constraints are examined of conventional X-radiographic and neutron imaging methods. Two types of solid-state image amplifiers designed to image X-rays are described. Operational theory, panel construction, and performance characteristics are discussed. A closed-circuit television system for imaging neutrons is described also; and the system for imaging neutrons is described also; and the system design, operational theory, and performance characteristics are outlined. Emphasis is placed on a description of the advantages of these imaging systems over conventional methods. Author

N72-27518* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ADVANCED MATERIALS INSPECTION TECHNIQUES
McIlwain *In its* Res. Achievements Rev. 30 May 1972 p 21-28 refs (For availability see N72-27516 18-15)
CSCL 14D

The new and somewhat unique inspection problems, brought about by the introduction of coated refractory metals and filamentary composites in the space shuttle program, are considered. In-house and contractual efforts aimed at solving these problems are discussed. Author

N72-27519* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
GASEOUS FLOW DETECTION TECHNIQUES FOR IN-SPACE APPLICATION
T. F. Morris *In its* Res. Achievements Rev. 30 May 1972 p 29-34 (For availability see N72-27516 18-15)
CSCL 14D

To meet the requirement for gaseous flow detection in the environment of space, a flowmeter and leak detector were developed. The operation of the flowmeter is based on the orifice-meter measuring system and the flowmeter makes corrections for gas temperature variation internally. The flowmeter is self-contained, portable, and hand-held and is capable of handling hydrogen, helium, nitrogen, oxygen, organic vapors, and other common gases found in flight systems over a flow range of 5 to 9500 standard cubic centimeters per minute. Author

N72-27520* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
QUALITY AND RELIABILITY REQUIREMENTS FOR HYBRID MICROCIRCUITS
M. J. Berkebile *In its* Res. Achievements Rev. 30 May 1972 p 35-48 (For availability see N72-27516 18-15)
CSCL 14D

The methods and techniques are discussed which are used for deriving quality and reliability requirements applicable to the fabrication of hybrid microcircuits for space flight application. A three-phase test is described which was utilized to establish reliability requirements for voltage regulator circuits. The test revealed a large number of wire-bond and chip-to-substrate interface failures. Additional studies are described which were initiated to investigate beam leads and flip chips in an effort to alleviate the bonding problems that occurred on the voltage regulator circuits. Investigations being conducted to determine the power limitations on hybrids are also discussed. D.L.G.

N72-27521* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
BOND PROBLEMS CAUSED BY THERMAL EXCURSION
F. Villella *In its* Res. Achievements Rev. 30 May 1972 p 49-58 refs (For availability see N72-27516 18-15)
CSCL 14D

The failure mode caused by thermal deformation and thermal deformation effects on bond integrity are discussed. Thermocompression (TC) wedge bonding, ultrasonic bonding, and thermocompression ball (nailhead) bonding in small-signal transistors are considered. Repeated switching of these devices between high and low power at a rate that allows thermal expansion and contraction in the interconnecting wire causes the wire to flex at the point of reduced cross-sectional area until breakage finally occurs because of metal fatigue. It is shown that this thermal deformation is related to many factors such as device power dissipation, current density in the wire, wire dress and length, the thermal time constant, and frequency of operation. Author

N72-27522*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A SPIRAL GROOVE SEAL Patent-Application
Lawrence P. Ludwig and Thomas N. Strom, inventors (to NASA) 24 Jan. 1972 12 p
(NASA-Case-XLE-10326-4; US-Patent-Appl-SN-220051) Avail: NTIS HC $3.00 CSCL 11A

Mating flat surfaces inhibit leakage of a fluid around a stationary shaft. A spiral groove pattern produces a pumping action toward the fluid when the shaft rotates which prevents leakage while a generated hydraulic lifting force separates the mating surfaces to minimize wear. Provision is made for placing these spiral grooves in communication with the fluid to accelerate the generation of the hydraulic lifting force. NASA

N72-27523# National Bureau of Standards, Boulder, Colo. Inst. for Basic Standards.
PRECISION MEASUREMENT AND CALIBRATION: FREQUENCY AND TIME
B. E. Blair, ed. and A. H. Morgan, ed. Jun. 1972 569 p refs
(NBS-SP-300-Vol-5; LCC-68-60042) Avail: SOD $6.00 as C.13.10: 300/v. 5

A group of selected papers, monographs, and abstracts dealing with the precision measurement of specific physical quantities and related topics are presented. The reprints and abstracts are printed in chronological order for the period of

January 1960 through June 1969. The subjects discussed are: (1) frequency and time standards, (2) time scales, (3) distribution of frequency and time signals, (4) statistics of frequency and time standards, and (5) selected frequency and time references.
Author

N72-27524# National Bureau of Standards, Washington, D.C. Inst. for Applied Technology.
PRECISION MEASUREMENT AND CALIBRATION: COLORIMETRY
Isadore Nimeroff, ed. Jun. 1972 457 p refs
(NBS-SP-300-Vol-9; LCC-68-60042) Avail: SOD $5.50

Papers, monographs, abstracts and bibliographies dealing with the precision measurement of specific physical quantities and the calibration of related metrology equipment are presented. The technical aspects of the field of colorimetry are investigated. Subjects presented are: (1) spectrophotometry, (2) color vision, (3) color specifications, (4) sources and instrumentation, (5) color spacing and metamerism, and (6) appearance and gloss. The reports cover the period from January 1957 through August 1969.
Author

N72-27525# National Bureau of Standards, Washington, D.C.
THE INTERNATIONAL SYSTEM OF UNITS (SI)
Chester H. Page, ED.02ED. and Paul Vigoureux Apr. 1972 47 p Transl. into ENGLISH of "Le Systeme Inter. national d'Unites", Intern. Bur. of Weights and Meas., Paris, 1972 Supercedes NBS-SP-330, 1971 edition
(NBS-SP-330; LC-73-608985) Avail: SOD $0.30 as C 13.10:330/2

Resolutions and recommendations of the General Conference of Weights and Measures (CGPM) on the international system of units are reported. Explanations have been added as well as relevant extracts from the recommendations of the International Organization for Standardization (ISO) for the practical use of the system. Outlined are measurements, consistent with the theoretical definitions given here, which metrological laboratories can make to realize the units and to calibrate precision material standards.
Author

N72-27526*# Westinghouse Electric Corp., Baltimore, Md. Systems Development Div.
SUMMARY OF MODERATE DEPTH LUNAR DRILL DEVELOPMENT PROGRAM FROM ITS CONCEPTION TO 1 JULY 1972 Final Report
Jun. 1972 178 p refs
(Contract NAS8-26487)
(NASA-CR-123724; Rept-72-0522) Avail: NTIS HC $11.00 CSCL 13I

The results are summarized of a program aimed at the development of a lunar drill capable of taking lunar surface cores to depths of at least 100 feet. The technologies employed in the program are described along with the accomplishments and problems encountered. Recommendations are included for future concept improvements and developments.
D.L.G.

N72-27527*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHOD OF REPAIRING DISCONTINUITY IN FIBER GLASS STRUCTURES Patent Application
Leonard L. Gelb (Hercules, Inc.), William B. Helbert, Jr. (Hercules, Inc.), Ronald B. Enie (Hercules, Inc.), and Richard F. Mulliken, inventors (to NASA) Filed 9 May 1972 15 p
(Contract NAS1-6367)
(NASA-Case-LAR-10416-1; US-Patent-Appl-SN-251752) Avail: NTIS HC $3.00 CSCL 13C

A method for repairing damaged fiberglass structures is described. The development uses fiberglass cloth patches which have been zig-zag stitched around the periphery and fringed to a depth of one-fourth to one-half inch. The damaged area is repaired by applying an epoxy resin to fill the damaged area and aplying the fiberglass patch. The patch is then coated with additional resin and a second patch, larger than the first, is applied. The steps are repeated as often as necessary to form a smooth surface. Application of the procedure provides a repaired structure which has the same geometry and which is stronger than the original structure.
NASA

N72-27528*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTIMAL SPEED SHARING CHARACTERISTICS OF A SERIES-HYBRID BEARING
Lester J. Nypan, Hebert W. Scibbe, and Bernard J. Hamrock 1972 21 p refs Proposed for presentation at Intern. Lubrication Conf., New York, 9-12 Oct. 1972; sponsored by Am. Soc. of Mech. Engr. and Am. Soc. of Lubrication Engr.
(NASA-TM-X-68093; E-6507) Avail: NTIS HC $3.25 CSCL 13I

A series-hybrid bearing assembly consisting of a conical hydrostatic fluid-film bearing and a ball bearing is described. Computer studies are used to predict friction torque and life characteristics of a 150-millimeter ball bearing. A conical hydrostatic fluid-film bearing is designed for minimum friction and maximum speed reduction of the ball-bearing component of the series-hydrid bearing. At a thrust load of 4000 pounds and speeds corresponding to DN (bearing bore in millimeters times shaft speed in rpm) values of 3 and 4 million, ball-bearing speed may be reduced by 30 percent. This speed reduction corresponds to ball-bearing fatigue life improvement factors of 3.4 at 3 million DN and 5.9 at 4 million DN. An oil flow rate of 18.2 pounds per minute is required to maintain a fluid-film thickness of 0.001 inch in the hydrostatic bearing.
Author

N72-27529*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUMMARY OF GAS BEARING APPLICATIONS IN THE FIELD OF SPACE ELECTRIC POWER SYSTEMS
James H. Dunn and Lloyd W. Ream 1972 12 p refs Proposed for presentation at 7th Intersoc. Energy Conversion Eng. Conf., San Diego, Calif, 25-29 Sep. 1972
(NASA-TM-X-68095; E-7010) Avail: NTIS HC $3.00 CSCL 13I

The testing and evaluation of different bearing systems to be used in the turbine-alternator-compressor of a closed Brayton cycle electric power system are described. A specification of each bearing is presented along with the results of the evaluation and a comparison of the merits and limitations of each bearing. The contribution of improved bearings to the power supply reliability, potential life, and ability to accept shock and vibration is examined.
P.N.F.

N72-27530*# Techtran Corp., Glen Burnie, Md.
PROPERTIES OF ORGANIC DRIVING MEDIA FOR DIFFUSION PUMPS IN TECHNICAL OPERATION AND A NEW FORM OF AN OIL DIFFUSION PUMP
R. Jaeckel Washington NASA Jul. 1972 23 p refs Transl. into ENGLISH from Z. Tech. Phys. (Leipzig), v. 23, no. 7, 1942 p 177-186
(Contract NASw-2037)
(NASA-TT-F-14276) Avail: NTIS HC $3.25 CSCL 13K

Advantages and disadvantages of oil diffusion pumps over mercury diffusion pumps are discussed related to the use of different types of organic driving media. These include apiezonoils, diesters of phthalic acid, and liphatic dibasic acids. Methods of use, operating properties, and experimental results are discussed.
Author

N72-27531# European Space Research and Technology Center, Noordwijk (Netherlands).
LANGMUIR PROBE SURFACE EFFECTS [EFFETS DE L'ETAT DE SURFACE D'UNE SONDE DE LANGMUIR]
A. Goufalone May 1971 13 p refs In FRENCH; ENGLISH summary
(ESRO-SN-115-ESTEC) Avail: NTIS HC $3.00

The effects of the surface state of a Langmuir probe have been studied experimentally. When the probe surface is heavily contaminated, the characteristic voltage/current curve shows an inflexion point at the floating potential. In general, the characteristic shows a hysteresis loop, which is possibly due to the presence of an insulating layer covering the probe surface. Several cleaning methods have been tested, such as neutral ion and ion bombardments, and the defects disappear if the probe is subjected in situ to the voltage from a Tesla coil. Of the various materials used, carbon in a vitreous or colloidal form seems to be least susceptible to contamination. Author (ESRO)

N72-27532# Technische Univ., Berlin (West Germany). Inst. fuer Flugfuehrung und Luftverkehr.

A NEW DIGITAL POSITION CORRECTING ELEMENT FOR AUTOMATISATION OF PROCESSES [EIN NEUARTIGES DIGITALES POSITIONSSTELLGLIED FUER DIE PROZESSTECHNIK]

Joachim Wernicke Oct. 1970 16 p In GERMAN
(Rept-57) Avail: NTIS HC $3.00

The prototype of a positioning device that uses a mechanical drive composed of a cascade of bevel gear differentials as a digital to analog converter was designed, thus eliminating the need for a complex electron converter. The device is characterized by the conversion of digital input to an angle digital to analog conversion by a mechanical drive without any servomechanism) a static operation which eliminated error accumulation, and high reliability and low costs. The system is described and its performance discussed. ESRO

N72-27533# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DAGGER FUSION OF METALS WITH AN ELECTRON BEAM

I. V. Zuev, N. N. Rykalin, and A. A. Uglov 3 Jan. 1972 19 p refs Transl. into ENGLISH from Fiz. i Khim. Obrabotki Materialov (USSR), no. 5, 1968 p 7-15
(AD-739289; FTD-HT-23-888-71) Avail: NTIS CSCL 13/8

It has been shown that, when welding with the dagger fusion and electron-beam treatment of metals, the energy transmission of the electron beam to a solid is accomplished by periodical thermal shocks. A thermal shock takes place at a certain depth on the surface of the body in the maximum energy release zone of the retarding electrons. There is proposed a temperature field equation, the action describing a three-dimensional heat source with an intensity, rising according to the Gaussian law, from the body's surface and reaching a peak at a certain depth. Author (GRA)

N72-27534# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

TESTING CAST IRON-HARDENED STEEL FRICTION PAIRS

V. D. Martynov 14 Dec. 1971 8 p refs Transl. into ENGLISH from Sb. State:, Politekhn, Inst. (Chelyabinsk, USSR), no. 59, 1969 p 76-80
(AF Proj. 7343)
(AD-739278; FTD-HT-23-1095-71) Avail: NTIS CSCL 13/9

The use of sulfiding and the use of molybdenum disulfide as a coating and as an additive to lubricants is an effective measure which increases the supporting power of cast iron-hardened steel friction pairs. Author (GRA)

N72-27535# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE EFFECT OF VIBRATION FREQUENCY ON STATIC FRICTION

V. M. Kobelev and Yu. F. Kopelev 14 Dec. 1971 9 p refs Transl. into ENGLISH from Teor. Mekhanizmov i Mashin, Resp. Mezhvedomstvennyi Nauchno-Tekhn. Sb. (USSR), no. 5, 1969 p 76-78
(AF Proj. 7343)
(AD-739279; FTD-HT-23-1239-71) Avail: NTIS CSCL 20/11

The effect of vibration of elements of a friction pair on the coefficient of static friction is considered. An experiment carried out for three friction pairs on a special stand at frequencies from 500 to 800 hertz is described. The results of the experiment verify the necessity of considering the dynamic characteristics of friction. GRA

N72-27536# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PRECISION ELECTRON BEAM WELDING AND EQUIPMENT

O. K. Nazarenko 14 Dec. 1971 24 p refs Transl. into ENGLISH from Finommechanika (Hungary), v. 9, no. 7, 1970 p 201-109
(AD-739282; FTD-HT-23-1522-71) Avail: NTIS CSCL 13/8

The article is concerned with the industrial applications of precision electron-beam welding. The factors which are critical to the production of a high quality, reproducible welded joint are discussed. The basic equipment used in precision electron-beam welding and the many possible applications of joints welded by electric beams are described. Author (GRA)

N72-27537# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ANALYSIS OF THE OPERATING CONDITIONS OF GAS TURBINE ROTOR BEARINGS FROM AN ELECTRONIC COMPUTER CALCULATION OF THEIR THERMAL REGIME

V. M. Demidovich and V. A. Chernoglazov 15 Dec. 1971 12 p ref Transl. into ENGLISH from Tr. Aviats. Inst. Kazan (USSR), no. 110, 1969 p 122-127
(AF Proj. 7343)
(AD-739209; FTD-HT-23-1231-71) Avail: NTIS CSCL 13/9

Results are shown of a large series of thermal calculations of a type of roller bearing very frequently used as gas turbine engine compressor rotor bearings. The calculations were performed with reference to two types of lubricant (transformer oil and MK-8 oil) widely used in gas turbine engines. The program was set up in such a way that the total losses incurred in driving each of the bearings were first estimated for a single value of the operating temperature and the radial load at various rpm regimes. Author (GRA)

N72-27538# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

QUESTION OF EXPERIMENTALLY DETERMINING CERTAIN PARAMETERS FOR THE DURABILITY OF SLIDE BEARINGS WITH BUSHINGS MADE OF PLASTIC

O. S. Ezikashvili and M. E. Shilakadze 22 Nov. 1971 13 p refs Transl. into ENGLISH from TR. Gruzinsk. Politekhn. Inst. (Tiflis), no. 8, 1968 p 126-133
(AD-739212; FTD-MT-24-101-71) Avail: NTIS CSCL 13/8

The coefficients of friction of the title bearings were determined and the results of a theoretical investigation in this field were proven by means of a special stand enabling changes of slide rate and of radial loading during measurements at temperatures less than or equal to 70 degrees. The friction coefficients in the cases of both irregular and drop lubrication for plastic steel 45 couples (the plastic being kapron, resin 68, or polyformaldehyde) were determined. GRA

N72-27539# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CALCULATING THE WEAR INTENSITY OF GRAPHITE BEARINGS WHICH WORK UNDER LUBRICATION CONDITIONS WITH AGGRESSIVE LIQUIDS

D. V. Galivets 20 Jan. 1972 15 p refs Transl. into ENGLISH from Khim. Tekhnol. Resp. Mezhved. Nauchn.-Tekhn. Sb. (USSR), no. 14, 1968 p 74-78
(AF Proj. 7343)
(AD-738746; FTD-MT-24-1138-71) Avail: NTIS CSCL 13/9

Graphite bearings operating under conditions of lubrication with nitric acid, coupled with tins of stainless chrome nickel

austenite ferrite steel type EI-654 are investigated, and an equation is produced for determination of the intensity of wear and durability of their operation, indicating that the wear of graphite bearings is influenced more by the specific pressure than by the circular rotation of the shaft. The wear of graphite bearings is almost proportional to the cube of specific pressure and the square of the circular rotation rate of the pin. The equation differs from those to be found in the literature in its good agreement with experimental data and simplicity of application for practical calculations. Author (GRA)

N72-27540# Lehigh Univ., Bethlehem, Pa.
THE FATIGUE STRENGTH OF FILLET WELDED CONNECTIONS
Karl H. Frank Oct. 1971 135 p refs
(AD-739341; FEL-358.37) Avail: NTIS CSCL 13/5

The report describes a study of the fatigue behavior of fillet welded joints stressed perpendicular to the weld line. The study included an experimental phase in which the stress-life and cracking behavior of load and non-load carrying fillet weld joints was determined. This experimental study concentrated on the fatigue behavior in the transition region between high and low cycle fatigue. The second phase of the study was the determination of the fracture mechanics stress intensity factor for cracks at the weld toe or root of fillet welded joints. The finite element technique was used to determine the compliance of typical fillet welded joints. Author (GRA)

N72-27541# Army Topographic Command, Washington, D.C.
AN INVESTIGATION OF METHODS FOR ESTIMATING GRAVITY ANOMALIES AND THEIR APPLICATION TO HEIGHT DIFFERENCE DETERMINATION
Paul W. Woodbury Nov. 1971 98 p refs
(AD-737589; TOPOCOM-TR-1-10) Avail: NTIS CSCL 08/5

The horizontal gradients (of the vertical component) of gravity are accurately and efficiently measured in the field using gravimeter measurements and differential leveling. The measured horizontal gradients are used in conjunction with points of known anomaly to develop an analytical equation representing the anomaly profile or field. The osculating mode of multiquadric equations of topography and other irregular surfaces is applied using points of known anomaly and horizontal gradient to provide more accurate predictions of the anomaly field. The horizontal gradients are also used with measured gravity and an assumed vertical gravity gradient to determine gravimetric height differences. Height differences are also determined by utilizing the anomaly predictions and the correlation of anomaly with height in the free air gravity anomaly formula. Gravimetric heighting is found to produce the same size errors common to barometric leveling. Author (GRA)

N72-27542# Texas A&M Univ., College Station. Dept. of Industrial Engineering.
RELIABILITY ANALYSIS OF A PARALLEL STANDBY SYSTEM M.S. Thesis
James H. Brier 1971 96 p refs
(AD-739477) Avail: NTIS CSCL 14/4

The paper maximizes the mean time between failures subject to a cost constraint for a system consisting of N-1 subsystems in standby, each subsystem containing M identical components with constant failure rates in parallel. The mathematical feasibility of determining the reliability for particular values of N and M is investigated. Finally the paper demonstrates that the values of N and M which maximize the MTBF of the system do not necessarily maximize the reliability of that system for all time. Author (GRA)

N72-27543# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
EVALUATION OF FIRE RESISTANT LUBRICANTS FOR INDUSTRIAL GAS TURBINES
L. Gardner and G. Moon Nov. 1971 16 p refs
(AD-738477; DME-MP-56; NRC-12433) Avail: NTIS CSCL 11/8

The use of fire-resistant lubricants, of the phosphate ester type, in industrial gas turbines used for natural gas transmission is widely accepted. These fluids are more expensive than petroleum lubricants and a long service life is required to make their use economically viable. Little previous work has been done to develop methods for measuring thermal and oxidative stability of phosphate esters and the present report describes the adoption of two test procedures normally used for aircraft synthetic lubricants for this purpose. Test parameters were established using a long established proprietary phosphate ester fluid and then, using the same conditions, some fourteen candidate fluids were evaluated. In addition to the oxidation and thermal stability measurements, the fire resistance of all the fluids were measured using manifold ignition and low pressure spray tests. Author (GRA)

N72-27544# British Steel Corp., London (England). Metallurgy Dept.
MAGNETOHYDRODYNAMICS IN CASTING PROCESSES
J. Campbell and D. I. Dawson Jan. 1972 45 p refs
(PB-207429; MG/58/71) Avail: NTIS HC $3.00 CSCL 13H

Naturally occurring and induced electromagnetic effects in casting processes are reviewed with an emphasis on consumable and non-consumable electrode processes. Skin effects and various types of naturally occurring stirring modes are discussed. Modification of such stirring can be achieved in a number of ways by the imposition of external magnetic fields, either stationary or rotating. Electromagnetically induced vibratory or oscillatory interactions are also described. Process and plant operational control that can be achieved are discussed in terms of plasma and liquid motions, and associated chemical and electrical effects. Author (GRA)

N72-27545# British Steel Corp., London (England). Metallurgy Dept.
IMPROVED PROPERTIES BY DIRECT QUENCHING
G. Tither, J. Kewell, and M. G. Frost Jan. 1972 21 p refs
(PB-207425; MG/35/71) Avail: NTIS HC $3.00 CSCL 13H

The advantages on mechanical properties by quenching directly after hot deformation and tempering are discussed in detail, and it is shown that increased precipitation strengthening efficiency is achieved by the process in comparison with the conventional reheat, quench and temper treatment. This improvement in strength is generally achieved while still maintaining very good impact resistance. The results of experiments applicable to commercial practice, viz., finish rolling temperature and delay time between working and quenching are also reported. The properties obtained by interrupting the quench and subsequently air cooling are discussed and the feasibility of the process assessed. Author (GRA)

N72-27546# SKF Industries, Inc., King of Prussia, Pa.
EXPLORATORY ANALYSIS OF ELASTOHYDRODYNAMIC PROPERTIES OF LUBRICANTS Quarterly Progress Report, 6 Aug. - 6 Nov. 1971
Y. P. Chiu, D. Hahn, and N. Rosenberg 6 Jan. 1971 70 p refs (Contract N00019-71-C-0425)
(AD-739390; SKF-AL72P001; QPR-2) Avail: NTIS CSCL 11/8

Experiments were conducted for measurement of sliding traction and optical film thickness in the 4:1 elliptical contact of a spherical bearing roller and a flat disk. A total of seven advanced engine lubricants were tested comprising three ester based lubricants, a modified polyphenyl ether, a synthetic napthenic hydrocarbon and two synthetic paraffinics (with and without anti-wear additives). Theoretical analysis was conducted which is capable of predicting increased film thickness reduction at high speed-viscosity parameters. The role of oil-air surface tension on elastohydrodynamics was defined in terms of the film replenishment in the rolling track. Author (GRA)

N72-27451 Engins Matra, Velizy (France). Division Optique.
ULTRASONIC MACHINING [ALLEGEMENT PAR ULTRA-SONS]
M. B. Busch *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 183-191 In FRENCH (For availability see N72-27435 18-14)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N72-27547 National Lending Library for Science and Technology, Boston Spa (England).
PULSED CO2 LASER WITH HIGH PRESSURE GAS MIXTURE
N. G. Vasov, E. M. Velenov et al 28 Feb. 1972 5 p refs Transl. into ENGLISH from Quantovaya Elektron, (USSR), v. 3, 1971 p 121-122
(NLL-DRIC-Trans-2644-(3623.66)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The characteristics of pulsed carbon dioxide laser with a high pressure gas mixture are presented. The equipment involved in operating the laser and the solution of various problems in order to obtain powerful ultrashort pulses of light are described. It was determined that a reduction in the generation pulse length with a simultaneous increase of energy can be achieved by further increasing the gas pressure. Pulses of ultrashort duration can be obtained in a regime of mode self-synchronization. P.N.F.

N72-27548*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POWER SUPPLY FOR CO2 LASERS Patent Application
Gerhard Schiffner, inventor (to NASA) Filed 9 May 1972 12 p (NASA-Case-GSC-11222-1; US-Patent-Appl-SN-251621) Avail: NTIS HC $3.00 CSCL 20E

An improved power supply for a carbon dioxide laser is described. The resistance versus frequency characteristics of a direct current excited carbon dioxide laser tube shows that such a laser tube exhibits a negative resistance characteristic only at relatively low frequencies. Such lasers show a decrease in amplitude and frequency fluctuations at high frequencies. Circuit diagrams of two embodiments of the invention in which an inductance is substituted for the ballast resistor to provide the necessary compensation for the negative differential resistance characteristic of a carbon dioxide laser at low frequencies are presented. It is concluded that an inductance may be used to provide the necessary negative resistance cancellation required by a carbon dioxide laser power supply thus eliminating the need for a ballast resistor. NASA

N72-27549*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ABSOLUTE FREQUENCY OF AN ATOMIC HYDROGEN MASER CLOCK
H. E. Peters, R. G. Hall (Naval Observatory), and D. B. Percival (Naval Observatory) Jun. 1972 5 p refs Submitted for publication
(NASA-TM-X-65936; X-524-72-225) Avail: NTIS HC $3.00 CSCL 20E

An accurate determination was made of the unperturbed atomic hydrogen ground state hyperfine transition frequency (F=1,m=0 - F=0,m=0) in reference to present world wide realizations of internationally defined time interval. In relation to the international atomic time system, the composite value is 1,420,405,751.7755 plus or minus 0.0031 HZ. Author

N72-27550*# Maryland Univ., College Park. Dept. of Electrical Engineering.
CO2 LASER COLD CATHODE STUDY Progress Report
U. Hochuli Jan. 1972 27 p
(Grant NGR-21-002-216)
(NASA-CR-122441) Avail: NTIS HC $3.50 CSCL 20E

The procedure for evaluating reliable sputter-free cold cathodes for carbon dioxide lasers is discussed. The purpose of the development is to obtain cold cathodes with service life in excess of 10,000 hours. Discharge tubes are used to eliminate the materials which would be unsatisfactory for use as a cold cathode. A description of the facility for producing the discharge tubes is described. The gas monitoring technique for determining discharge tube performance is examined. Discharge characteristics of tubes with various metals for cathode material are presented in chart form. P.N.F.

N72-27551# Lockheed Missiles and Space Co., Palo Alto, Calif.
SECOND HARMONIC GENERATION OF A NEODYMIUM LASER BY CRYSTALLINE POWDERS OF ORGANIC COMPOUNDS
E. A. Tikhonov and M. T. Shpak [1972] 17 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 17, no. 2, 1972 p 190-201
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chciago, Ill. 60616

An analysis of materials suitable for second harmonic generation of a neodymium laser by crystalline powders of organic compounds is discussed. Principal attention is directed to determining the mechanism that causes the magnitude of the nonlinear coefficients of some organic compounds used as the initial products for dye synthesis. The prospect of using molecular crystals of complex organic compounds as nonlinear optical materials was considered because of their inherent properties. A numerical analysis of the third rank nonlinear susceptibility tensor which determines the intensity of the second harmonic is presented. Author

N72-27552# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
HIGH FREQUENCY, SINGLE FREQUENCY LASER AND MODULATOR STUDY Annual Technical Report No. 1, 1 Sep. 1970 - 30 Sep. 1971
Robert C. Ohlmann, W. Culshaw, K. K. Chow, H. V. Hance, and W. B. Leonard Sep. 1971 97 p refs
(Contract N00014-71-C-0049; ARPA Order-306)
(AD-738489; LMSC-N-JY-71-8) Avail: NTIS CSCL 20/5

Theoretical and experimental studies on (1) mode filters for single-frequency Nd:YAG lasers and (2) wide-bandwidth optical modulators are reported. Stable single-frequency output power of 0.8W was obtained from a Nd:YAG laser pumped by a 1-kW tungsten lamp. The mode filter consisted of a tilted etalon and a thin metallic film in the laser cavity. Detailed analyses have been made to reduce the insertion loss of mode filters to an absolute minimum so that efficiency can be increased. The electro-optic modulator uses a microwave interdigital filter structure and has a 1.4-GHz bandwidth. A new circuit design aimed at increasing modulation depth for a given rf power has been obtained and tested. No optical damage or beam distortion of LiNbO3 was observed under continuous radiation of 14 kW/sq cm green light when the crystal was at 180C.
Author (GRA)

N72-27553# Stanford Univ., Calif. Microwave Lab.
METHODS FOR OBTAINING LASER ACTION AT WAVELENGTHS SHORTER THEN 3000 A Semiannual Status Report, 1 Sep. 1970 - 28 Feb. 1971
R. H. Pantell Apr. 1971 26 p
(Contract N00014-67-A-0112-0033; NR Proj. 016-107)
(AD-739377; ML-1954; SASR-4) Avail: NTIS CSCL 20/5

The general objective of this research program is to investigate a method for achieving broadly tunable laser action in the ultraviolet and beyond. Author (GRA)

N72-27554# GTE Labs., Inc., Bayside, N.Y.
HIGH-ENERGY PULSED LIQUID LASER Semiannual Technical Summary Report, 1 Aug. 1971 - 30 Jan. 1972
Harold Samelson, Alexander Lempicki, and Robert Kocher 28 Feb. 1972 58 p refs
(Contract N00014-68-C-0110; NR Proj. 015-630)
(AD-739715; TR-72-826.2) Avail: NTIS CSCL 20/5

The objective of this program is to evaluate the liquid laser, based on Nd(-3) -ZrCl4 POCl3, as a means for producing high energy pulses and in a repetitively-pulsed mode of operation, high average powers. The problem of water contamination in the circulatory system of the liquid laser is considered in detail. A spectroscopic method is presented for measuring this contamination and techniques for keeping it low are described. In addition, an acceptable upper limit for water contamination is obtained. Information on the compatibility of various materials with the laser liquid is also given leading to specific recommendations for system construction materials. The Q-switched oscillator system was assembled and tested using the above techniques. Results of experiments in both the long-pulse and Q-switched modes of operation are presented. The problems of measuring and specifying multi-mode laser beam divergence are also considered. Author (GRA)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N72-27555 National Lending Library for Science and Technology, Boston Spa (England).
POLYCRYSTALLINE METAL WHISKERS FOR COMPOSITES
H. J. Schladitz 29 Feb. 1972 16 p refs Transl. into ENGLISH from Fachberichte fuer Oberflaechentech. (West Germany), 1971 p 145-150 In ENGLISH and GERMAN
(NLL-Trans-746-1106-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The production and application of polycrystalline metal whiskers for composite materials are discussed. The properties of polycrystalline metal whiskers are described. It is stated that the average strength of polycrystalline whiskers is far above the average strength of other metal whiskers or high-strength, non-metallic fibers. The methods for increasing the strength of composite materials with polycrystalline metal fibers are explained and the properties of these fibers are compared with those of more conventional fibers such as fiber glass, boron, and graphite. Author

N72-27556 National Lending Library for Science and Technology, Boston Spa (England).
TWO-STAGE SURFACE-HARDENING
A. Kulmburg, D. Schmidt, and K. Swoboda 29 Feb. 1972 24 p Transl. into ENGLISH from Haerterei-Tech. Mitt. (West Germany), v. 26, 1971 p 111-120 In ENGLISH and GERMAN
(NLL-Trans-746-1100-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Properties and service life of surface layers of metastable austenite are considered. Tests were conducted on wear-exposed components and cutting tools in order to evaluate the behavior of the austenite. Processes aimed at control of the diffusion zone are discussed. Control of the core material during ion nitriding is also considered. The effects of variations in layers on surface ductility were also investigated. K.P.D.

N72-27557 National Lending Library for Science and Technology, Boston Spa (England).
DETERMINATION OF THE WORK-HARDENING EXPONENT FROM THE LOAD-STRAIN-CURVE
W. Heye and H. P. Sattler 29 Feb. 1972 8 p refs Transl. into ENGLISH from Materialpruefung (Duesseldorf), v. 13, 1971 p 273-275 In ENGLISH and GERMAN
(NLL-Trans-746-1121-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The relationship between uniform elongation and work hardening is presented mathematically using the theory of shaping. A technique is proposed for rapid determination of the work hardening coefficient without the use of a computer. Force-strain and true stress-strain curves were determined simultaneously by repeated stressing and stress-relieving on sheet and spherical specimens, using Al 99.5, SF-Cu, E-Cu, brass (CuZn 30 and CuZn 15), and steel of a deep-drawing grade. K.P.D.

N72-27558 National Lending Library for Science and Technology, Boston Spa (England).
DEVELOPMENT OF THE FLOTATION OF PARTICLES OF LIMITING SIZE
V. D. Samygin Mar. 1972 83 p refs Transl. into ENGLISH from Obogashch. Polezn. Iskop., Akad. Nauk SSR, Inst. Gorn. Dela (Moscow), 1968 p 5-41
(NLL-RTS-6963) Avail: Natl. Lending Library, Boston Spa, Engl.: £5.00; 17 NLL photocopy coupons

The problem of flotation of slimes and finely disseminated ores is considered. Special features in the extraction of fine and coarse particles in flotation are presented. The mechanism of the influence of slimes on the flotation process is also discussed. The flotation of fine mineral particles by gas given off from solutions and methods for the selective enlargement of fine particles into aggregates of optimal flotation size are reviewed. Technological procedures are presented which decrease the nonselective carry-off of fine gangue particles. Methods of eliminating the influence of slime and the choice of a rational scheme of crushing finely disseminated and strongly slime-forming ores were investigated. Equipment for the flotation of coarse particles is also considered. K.P.D.

N72-27559 National Lending Library for Science and Technology, Boston Spa (England).
SELECTION OF INTERMEDIATE LAYERS FOR CORROSION RESISTANT BIMETALS
S. A. Golovanenko and I. Y. Konnova Jan. 1972 16 p refs Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 7, 1971 p 38-43 In RUSSIAN and ENGLISH
(NLL-Trans-746-1147-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The selection of intermediate layers of material for construction corrosion-resistant bimetal is discussed. The corrosion-resistant bimetal consists of two components: (1) a cladding layer of corrosion resistant steel, and (2) a substrate of carbon steels. During heating, change in distribution of the elements between the two components occurs. The application of an intermediate layer between the base and cladding layers of the bimetal can considerably retard the migration of carbon between them. Author

N72-27560 National Lending Library for Science and Technology, Boston Spa (England).
CREEP RUPTURE STRENGTH AND ELECTRON MICROSTRUCTURES OF 2 1/4 PERCENT Cr-1 PERCENT Mo STEELS AFTER HEAT TREATMENTS
K. Suzuki, T. Nishi, and T. Muta 7 May 1972 19 p refs Transl. into ENGLISH from J. Soc. Mater. Sci. (Japan), v. 19, Mar. 1970 p 188-195
(NLL-CE-Trans-5594-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The relation between creep rupture strength and the electron microsturctures of 2 1/4% Cr-1% Mo steel in heat treatment conditions were investigated. The results were: (1) Curves of creep stress-time are linear or almost linear in stabilized and semistabilized structures and that of unstabilized

structures shows knick point in curve at 600 C, 1,000 hrs. (2) There is no change in the microstructure of stabilized specimens during the creep test at 600 C, but that of unstabilized specimens changes to match the gradient of stress-rupture curves. (3) The interactions between one dislocation and another or between dislocation and the precipitates are important factors of creep rupture strength. (4) The activation energy of creep calculated by Zener-Hollomon parameter, agrees well with that of diffusion of Cr atom when the structure is stabilized by long time annealing. (5) The recovery and recrystalization are observed at creep deformed zones preferentially. (6) The long time rupture strength of the test specimen will be easily and accurately estimated by annealing it for a long time and so stabilizing its structure. The plot calculated by Dorn, parameter with the experimental values of the stabilized specimen agrees with Dorn master curve. Author

N72-27561 National Lending Library for Science and Technology, Boston Spa (England).
ACTIVITY AND SOLUBILITY OF CARBON IN AUSTENITIC CHROMIUM-NICKEL STEELS WITH APPROXIMATELY 18% Cr
H. Tuma 7 Jun. 1972 14 p refs Transl. into ENGLISH from Arch. Eisenhuettenw. (Duesseldorf), v. 41, no. 10, Oct. 1970 p 983-988
(NLL-CE-Trans-5881-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

An investigation was made to determine the solubility of carbon and the precipitation of carbides in iron-carbon alloys with approximately 18% Cr as a function of nickel contents of up to approximately 40% by carburization tests in hydrogen-methane mixtures at temperatures between 900 and 1200 C. The data obtained was evaluated to allow calculation of activity and solubility. The results of an X-ray structural analysis of the isolated carbides are reported. Author

N72-27562 National Lending Library for Science and Technology, Boston Spa (England).
DYNAMIC STRAIN-AGING OF S.G. IRON
S. Riegger, O. Voehringer, and E. Macherauch 4 Apr. 1972 8 p refs Transl. into ENGLISH from Giessereiforschung (Duesseldorf), v. 23, 1971 p 85-87 In ENGLISH and GERMAN
(NLL-Trans-746-1167-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The occurrence and disappearance of discontinuous deformation phenomena as a function of strain rate and temperature were studied for spherulitic graphite iron. The results and their interpretation are presented. Author

N72-27563 National Lending Library for Science and Technology, Boston Spa (England).
ENLARGEMENT OF DISPERSED INCLUSIONS OF OXIDES IN NICHROME DURING ANNEALING
V. N. Antsiferov and R. R. Yablonovskaya 4 Apr. 1972 9 p refs Transl. into ENGLISH from Poroshkovaya Met., Akad. Nauk Ukr. SSR (Kiev), no. 6, 1971 p 66-69
(NLL-Trans-746-1173-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The grain growth of a metallic matrix - Nichrome - and the behavior of ZrO2 and A12O3 oxides in the Nichrome matrix during annealing at 900 and 1150 C were investigated by methods of optical and electron microscopy. During dispersion hardening, the final structure in the hot extruded alloys is the result of two concurrent processes - the collective recrystallization of the initial grains and the recrystallization by nucleation. At the first stages of annealing, the basic process is the growth of the initial grains, leading to the formation of large accumulations of the disperse phase by their displacement by the growing grain boundaries. With an increase in the time of annealing, the metallographically visible growth of the recrystallization nuclei begins; it leads to an enlargement of the finely dispersed portion of the dispersed phase. Annealing in air leads to smaller enlargement of the dispersed phase than in hydrogen; this is apparently connected with the stabilizing effect of oxygen on the dissolution of small oxide particles. Author

N72-27564 National Lending Library for Science and Technology, Boston Spa (England).
PLASTICITY OF METALS UNDER HIGH PRESSURE, PART 2
Masao Nishihara and Toru Fujita 11 Apr. 1972 20 p refs Transl. into ENGLISH from Zairyo (Kyoto), v. 20, 1971 p 802-808 In JAPANESE and ENGLISH
(NLL-NEL-TT-2371-(6075.461)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The propriety of various hypotheses in theories of plasticity, the ductility of metals and other materials under high pressure, and the effect of pressurization on these materials were discussed. Behavior results were based on the length of time the materials were subjected to pressures. Author

N72-27565 National Lending Library for Science and Technology, Boston Spa (England).
MECHANICAL PROPERTIES AND COLD SHORTNESS OF LOW-ALLOY STEEL CONTAINING CERIUM
N. V. Nikitin 20 Apr. 1972 6 p refs Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 7, 1971 p 75-76
(NLL-T-518-(9022.305)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The effects of 0.02% to 0.11% cerium additions on the mechanical properties and susceptibility to brittle fracture of low alloy normalized steel are investigated. Experimental results show cerium additions from 0.02% to 0.05% slightly improves the strength of the steel but lowers its plastic properties. With additions of 0.11% the strength drops slightly as a result of carbon being combined into cerium carbide and from the reduction of the amount of pearlite component in the structure. It was concluded that cerium additions to low alloy steels increases impact strength, lowers ductility, reduces resistance to cold shortness, and increases susceptibility to brittle fracture. Author

N72-27566 National Lending Library for Science and Technology, Boston Spa (England).
INTERACTION OF NICKEL WITH TIN-LEAD SOLDER POS 61
T. T. Bocharova and B. I. Krimer 4 Apr. 1972 6 p refs Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 8, 1971 p 65-66 In RUSSIAN and ENGLISH
(NLL-Trans-746-1155-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Processes were investigated which occur during the interaction of molten Sn-Pb solders with a Ni coating. The study was conducted on samples of electrolytic Ni during contact with the solder POS 61 from 220 to 500 C for times from 3 to 300 minutes in length. The microstructure of the transition zone between the Ni and solder was analyzed. Author

N72-27567 National Lending Library for Science and Technology, Boston Spa (England).
PROPERTIES OF CAST CHROMIUM-NICKEL ALLOYS, ALLOYED WITH NIOBIUM AND MOLYBDENUM
Y. A. Nekhendzi and E. M. Ionkina 4 Apr. 1972 9 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), v. 14, no. 3, 1970 p 148-151
(NLL-Trans-746-1143-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The effect of different niobium contents on the microstructure and degree of dispersion-hardening of cast Cr-Ni alloys, and also the effect of supplementary Mo alloying, was investigated. Alloys of the Ni-Cr-Nb and Ni-Cr-Nb-Mo systems were melted in an open induction furnace in a corundum or magnesite crucible (1.5 kg capacity). The charge consisted of virgin material: electrolytic nickel, metallic chromium, niobium and molybdenum. The alloys

were modified with ferroboron (from calculation 0.01% B). The castings were poured into hot ethyl-silicate moulds in the form of plates. Heat treatment of the samples was conducted without the application of protective atmospheres according to the following system: heating to 1200 C, soaking for 3 hours, quenching in air, tempering at 900 C, soaking for 16 hours, cooling in air. Samples in the untreated (initial cast) state and after quenching according to the system indicated were also tested. The effect of dispersion hardening was determined according to the hardness, measured at room temperature on the Rockwell apparatus; the comparative heat resistance was measured according to hardness at 740 C. Author

N72-27568 National Lending Library for Science and Technology, Boston Spa (England).
SUPERPLASTICITY OF NICKEL-CHROMIUM EUTECTIC ALLOY
A. S. Tikhonov, V. G. Osipov et al 4 Apr. 1972 10 p refs Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 9, 1971 p 28-31 In ENGLISH and RUSSIAN
(NLL-Trans-746-1185-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The superplasticity properties of nickel-chromium eutectic alloy are discussed. The effect appeared at unusually high values of relative elongation of the alloy at temperatures of 800 to 1200 C. Basic prerequisities for the emergence of the superplasticity effect relative to two-phase alloys are: (1) the presence of variable solubility of the components of the alloys, (2) the kinetic correlation of deformation processes and diffusion processes, contributing to an increase in plasticity, (3) the finely-dispersed structure of the alloys to give considerable area for the surface of integration of the phases, and (4) a sufficiently high temperature to obtain diffusion mobility of the atoms.
Author

N72-27569 National Lending Library for Science and Technology, Boston Spa (England).
STRUCTURAL DIAGRAM OF DEFORMED STAINLESS STEELS
Y. M. Potak and E. A. Sagalevich 4 Apr. 1972 10 p refs Transl. into ENGLISH from Metalloved. Term. i Obrab. Metallov (USSR), no. 9, 1971 p 12-16 In ENGLISH and RUSSIAN
(NLL-Trans-746-1176-(9022.401)) Avail: Natl. Lending Library, Boston Spa Engl.: 1 NLL photocopy coupon

The use of Schaeffler's diagram to evaluate the class and structural state of stainless steels is discussed. A semiquantitative structural diagram is proposed for low carbon stainless steel of the austenitic, austenitic-martensitic, martensitic, martensitic-ferritic, and austenitic-ferritic classes. The diagram was constructed on the basis of a determination of the structure of 110 stainless steels of different compositions. K.P.D.

N72-27570 National Lending Library for Science and Technology, Boston Spa (England).
THE DEGASIFICATION OF SILUMIN ALLOY MELTS BY MEANS OF TREATMENT WITH LUMPY TITANIUM
Kurt Anderko 20 Apr. 1972 5 p refs Transl. into ENGLISH from German report
(NLL-294-(8660.5)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Considerations are presented relating to solubility and diffusion in the titanium-hydrogen and aluminum-hydrogen systems. From these it is expected that lumpy titanium would exercise a strong degasifying effect upon hydrogen-containing aluminum and aluminum alloy melts. Tests made on the alloy G-AlSi10Mg, which is refined with sodium, and on the piston alloy G-AlSil2CuNiMg demonstrate the occurrence of the expected effect. Author

N72-27571 National Lending Library for Science and Technology, Boston Spa (England).
FLOW STRESS AND STRAIN RATE DURING EXTRUSION
H. P. Stuewe 4 Apr. 1972 11 p refs Transl. into ENGLISH from Z. Metallk. (West Germany), v. 62, 1971 p 697-701 In ENGLISH and GERMAN
(NLL-LTI-746-1181-(9022.401)) Avail: Natl. Lending Library, Boston Spa Engl.: 1 NLL photocopy coupon

An empirical equation to describe the flow stress of metals at elevated temperatures has been proposed. The evaluation of experiments according to this equation is described and the validity of approximations are discussed. The strain rate sensitivity can be derived from this equation. The choice of a mean strain rate in extrusion (to be used for the calculation of a mean flow stress) is discussed. Author

N72-27572 National Lending Library for Science and Technology, Boston Spa (England).
OBTAINING THE NICKEL-TIN ALLOY WITH THE HELP OF HYDRAZINE HYDRATE
A. V. Izmailov and E. A. Sobolev 4 Apr. 1972 7 p refs Transl. into ENGLISH from Zh. Fiz. Khim. (USSR), v. 45, no. 10, 1971 p 2652-2654 In ENGLISH and RUSSIAN
(NLL-Trans-746-1196-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL Photocopy coupon

The possibility of depositing a nickel-tin alloy by chemical reduction with hydrazine hydrate was investigated. A stable composition of the solution for depositing this alloy was developed. Author

N72-27573*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A NEW CRITERION FOR PREDICTING ROLLING-ELEMENT FATIGUE LIVES OF THROUGH-HARDENED STEELS
James L. Chevalier, Erwin V. Zaretsky, and Richard J. Parker 1972 24 p refs Proposed for presentation at Intern. Eng. Conf., New York, 9-12 Oct. 1972; sponsored by Am. Soc. of Mech. Eng. and Am. Soc. of Lubrication Eng.
(NASA-TM-X-68078; E-6760) Avail: NTIS HC $3.25 CSCL 11F

A carbide factor was derived based upon a statistical analysis which related rolling-element fatigue life to the total number of residual carbide particles per unit area, median residual carbide size, and percent residual carbide area. An equation was experimentally determined which predicts material hardness as a function of temperature. The limiting temperatures of all of the materials studied were dependent on initial room temperature hardness and tempering temperature. An equation was derived combining the effects of material hardness, carbide factor, and bearing temperature to predict rolling-element bearing life. Author

N72-27574*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HYDROGEN ENVIRONMENT EMBRITTLEMENT
Hugh R. Gray 1972 30 p refs Presented at Standardization of Test Methods for Hydrogen Embrittlement, Los Angeles, 26 Jun. 1972; sponsored by Am. Soc. for Testing and Mater.
(NASA-TM-X-68088; E-6995) Avail: NTIS HC $3.50 CSCL 11F

Hydrogen embrittlement is classified into three types: internal reversible hydrogen embrittlement, hydrogen reaction embrittlement, and hydrogen environment embrittlement. Characteristics of and materials embrittled by these types of hydrogen embrittlement are discussed. Hydrogen environment embrittlement is reviewed in detail. Factors involved in standardizing test methods for detecting the occurrence of and evaluating the severity of hydrogen environment embrittlement are considered. The effect of test technique, hydrogen pressure, purity, strain rate, stress concentration factor, and test temperature are discussed. Additional research is required to determine whether hydrogen environment embrittlement and internal reversible hydrogen embrittlement are similar or distinct types of embrittlement. Author

N72-27575*# Case Western Reserve Univ., Cleveland, Ohio.
THE EFFECT OF ALLOYING ON GAMMA AND GAMMA PRIME IN NICKEL-BASE SUPERALLOYS Contractor Report, Jul. 1970 - May 1972
R. L. Dreshfield and J. F. Wallace May 1972 135 p refs
(Grant NGR-36-027-019)
(NASA-CR-120940) Avail: NTIS HC $8.75 CSCL 11F

An investigation was conducted to determine the compositional limits of gamma and gamma prime phases in nickel-base superalloys. Fifty-one nickel-base alloys were melted under vacuum and heat treated for 4 hours at 1190 C followed by 1008 hours at 850 C. The alloys had the following composition ranges: Al 4.0 to 13 atomic percent, Cr 6.5 to 20.5 percent, Ti 0.25 to 4.75 percent, Mo 0.0 to 6.0 percent, and W 0.0 to 4.0 percent. The residues from the ammonium sulfate electrolytic extraction for the two-phase alloys were analyzed chemically and by X-ray diffraction. The results of the investigation were used to assemble a mathematical model of the gamma-gamma prime region of the Ni-Al-Cr-Ti-Mo-W system. A computer program was written to analyze the model of the phase diagram. Some of these results are also presented graphically. The resulting model is capable of satisfactorily predicting the compositions of conjugate gamma-gamma prime phases in the alloys investigated and twelve of fifteen commercial superalloys studied. Author

N72-27576*# Techtran Corp., Glen Burnie, Md.
STUDY OF CONVERSIONS IN THE PLATINUM-IRON SYSTEM
A. Kussman and G. VonRittberg Washington NASA Jul. 1972 21 p refs Transl. into ENGLISH from Z. Metallk. (West Germany), v. 41, 1950 p 470-477
(Contract NASw-2037)
(NASA-TT-F-14320) Avail: NTIS HC $3.25 CSCL 11F

The platinum-iron system is examined with the aid of magnetic, electrical, and dilatometric measurements as well as X-ray structural determinations. Proof is given for two new super lattice phases, Fe3Pt and FePt3, and a ferromagnetic region of platinum-rich alloys. Details of Fe3Pt are given and a new conversion diagram is proposed. Author

N72-27577*# Kawecki Berylco Industries, Inc., Reading, Pa.
AN ELECTROLYTIC PROCESS FOR ULTRA FINE BERYLLIUM Final Report
W. G. Lidman and V. Griffiths 30 Jun. 1972 14 p refs
(Contract NASw-1844)
(NASA-CR-127427) Avail: NTIS HC $3.00 CSCL 11F

Studies were made on the electrolysis of a molten BeCl2-NaCl bath using a mercury cathode and beryllium anode. A quasi-amalgam was obtained. The beryllium was consolidated by direct hot pressing of the amalgam at temperatures in the range of 800 C and using pressures of 5,000, 10,000 and 20,000 psi. The work confirms the ability to produce ultrafine beryllium particles by electrolysis. Author

N72-27578# Joint Publications Research Service, Arlington, Va.
AUSTENITIC-BORIDE STEELS AND ALLOYS FOR WELDED STRUCTURES
B. I. Medovar, N. I. Pinchuk, and L. V. Chekotilo 30 Jun. 1972 167 p refs Transl. into ENGLISH from the book "Austenitno-Boridnyye Stali i Splavy Dlya Svarnykh Konstruktsiy; Naukova Dumka Publishing House, Kiev, 1970
(JPRS-56406) Avail: NTIS HC $10.50

Data for the alloying of austenite steels and alloys with iron-chromium-nickel, iron-chromium-manganese, and chromium-nickel compositions, to boron are presented. The effect of boron on the structure and characteristics of these materials is considered. Attention is devoted to investigating the effect of boron on the weldability, tendencies to local erosion, splitting corrosion, refractoriness and resistance to sintering, of steels and alloys. Descriptions are given of the structure and characteristics of new brands of austenite-boride steels and alloys to be used as parts in the welding construction of power, chemical, and other types of machinery, and of the welding process for austenite-boride steels and alloys. Author

N72-27579# Fraunhofer-Gesellschaft zur Forderung der Angewandten Forschung e. V., Freiburg (West Germany). Inst. fuer Festkoerper Mechanik.
MEASUREMENT OF THE FRACTURE TOUGHNESS KIc OF THE STEEL HFX 103 AT DIFFERENT STRENGTH LEVELS [MESSUNG DER RISSZAEHIGKEIT KIc FUER DEN STAHL HFX 103 IN VERSCHIEDENEN VERGUET-UNGSSTUFEN]
Johann Georg Blauel Nov. 1971 25 p refs In GERMAN
(T-MITT-4/71) Avail: NTIS HC $3.25

Fracture strength measurements were carried out for high strength steel 38 Ni Cr MoV 73, of the quality HFX 103 to investigate the weldability of these steels. The fracture strength was measured at room temperature for the material after weak glowing, after quenching in oil at 850 C, and after quenching and two-hour annealing at 200, 300, 400 and 500 C. Compact tensile samples and three point bending samples of different thicknesses were tested. The results were compared with technical characteristics of normal round tensile specimens. The structural changes resulting from different heat treatments, observed from fracture surfaces and metallographic photographs, lead to clear modifications of the characteristics. ESRO

N72-27580# Massachusetts Inst. of Tech., Cambridge. Center for Materials Science and Engineering.
STRUCTURE AND PROPERTY CONTROL THROUGH RAPID QUENCHING OF LIQUID METALS Semiannual Technical Report, 1 Jul. - 31 Dec. 1971
Nicholas J. Grant, Regis M. N. Pelloux, Merton C. Flemings, and Ali S. Argon 1 Jan. 1972 130 p refs
(Contract DAHC15-70-C-0283; ARPA Order 1608)
(AD-739340; SATR-3) Avail: NTIS CSCL 11/6

Various powder metallurgy (P/M) and quench-casting techniques were employed to generate extremely fine dendrite arm spacings and homogeneous structures. Iron, nickel and cobalt-base alloy powders, produced by steam atomization (coarse powders), argon atomization, vacuum atomization, and the rotating electrode process, were consolidated into dense billets by hot isostatic pressing (HIP) and/or extrusion. New powder processes based on separating solid nodules from a liquid-solid mixture and random breakup of a fine stream of liquid metal into spherical particles are being evaluated. The hot working properties of P/M billets and quench-cast bars were evaluated by hot rolling, high strain rate tests, and creep (superplastic) testing. Two P/M superalloys, MAR-M-509 (cobalt-base) and IN-100 (nickel-base) after HIP and hot extrusion demonstrated excellent hot workability under high strain rate and creep forming conditions, respectively. Author (GRA)

N72-27581# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
WEAR RESISTANCE OF TOOL STEELS AND ITS DEPENDENCE ON THE ELEMENTS IN MARTENSITE AND CARBIDES
I. I. Sidorin and N. A. Dolgova 30 Dec. 1971 11 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Mashinostr. (Moscow), no. 5, 1970 p 155-157
(AF Proj. 7343)
(AD-739276; FTD-HT-23-1062-71) Avail: NTIS CSCL 11/6

It is demonstrated by investigating the composition of the martensite and carbides in high alloy chrome vanadium steels that the wear resistance of all tool steels consisting of martensite and carbides depends basically on the degree of alloying of the martensite. An optimal composition for a wear resistant steel can be found only by using the curve of wear as a function of quantity of the alloying element. Author (GRA)

N72-27582# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PROBLEM OF THE DEPENDENCE OF WEAR

RESISTANCE OF METALS DURING ABRASIVE WEAR ON THEIR PHYSICOMECHANICAL PROPERTIES
S. S. Gregenyuk, L. S. Ermolov, and N. V. Slonovskii 23 Dec. 1971 11 p refs Transl. into ENGLISH from Izv. Vysshikh Uchbn. Zavedenii, Mashinostr. (USSR), no. 6, 1970 p 32-35
(AF Proj. 7343)
(AD-739277; FTD-HT-23-1063-71) Avail: NTIS CSCL 11/6

The article examines the dependence of wear resistance of metals during abrasive wear on the basic physicomechanical parameters. The dependence of wear resistance and critical velocity on the same parameters during friction of metals on an abrasive surface indicates the presence of thermoelastic processes in the surface layer, influencing wear resistance. Author (GRA)

N72-27583# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INCREASE IN WEAR RESISTANCE OF CHROME-NICKEL CAST IRONS BY MEANS OF ALLOYING BY NIOBIUM
V. A. Krivosheev, L. S. Rudnitskiy, P. P. Doroshchenko, and V. K. Fridrikhsen 15 Nov. 1971 12 p Transl. into ENGLISH from Tekhnol. Organ. Proizvod. (USSR), no. 4, 1969 p 29-31
(AD-739285; FTD-MT-24-115-71) Avail: NTIS CSCL 11/6

A study was made of the effect of niobium (0.1-0.78 percent) on the structure, mechanical properties, wear resistance, heat resistance, kinetics, martensite transformation, and isothermal breakdown of the austenite in a cast iron roller of composition: C - 3.0; Si - 0.38; Mn - 0.80; P - 0.14; S - 0.023; Cr 0.83; Ni - 3.97 percent. The properties of Cr-Ni rollers containing Nb in actual use for the hot rolling of thin sheet were studied. As a result, recommendations are made for alloying Cr-Ni sheet rolling with niobium 0.2 percent so as to increase their wear resistance and improve the quality of the sheet. GRA

N72-27584# Naval Air Development Center, Johnsville, Pa. Aero Materials Dept.
MECHANISM OF FATIGUE ENHANCEMENT IN SELECTED HIGH STRENGTH ALUMINUM ALLOYS Progress Report
Ronald E. Trabocco 10 Dec. 1971 29 p refs
(AD-738450; NADC-MA-7171) Avail: NTIS CSCL 11/6

The initial phase of an investigation concerned with the mechanism of fatigue enhancement in selected high strength/weight aluminum alloys was completed. Data indicate that in both X7080-T7 and X 7050, aluminum alloys fatigue enhancement is related to unique microstructures. In the case of the X7080 Al alloy it is the presence of aligned light etching regions and in the X 7050 alloy, it is the directional proliferation of precipitates predominately at grain boundaries. Author (GRA)

N72-27585# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMAL CONDUCTIVITY OF CHIATURA MANGANESE CONCENTRATES AND THEIR PELLETIZED PRODUCTS
G. U. Nikolaishvili and M. A. Kekelidze 29 Dec. 1971 15 p refs Transl. into ENGLISH from the monograph "Proizvodstvo i Primenenie Margantsevykh Ferrosplavov" Tiflis, 1968 p 28-36
(AD-739215; FTD-MT-24-1863-71) Avail: NTIS CSCL 11/6

An installation was developed for the determination of thermal conductivity. It is based on the quasi-stationary mode of heating. The coefficients of thermal conductivity of Chiatura manganese concentrates and products of their pelletizing were determined in the temperature range of 100-900 degrees C. It was established that the nature of change of lambda from the temperature of the investigated materials, besides carbonate, is identical - thermal conductivity increases with an increase in temperature, especially above 500 degrees C, when the fraction of thermal radiation increases. Author (GRA)

N72-27586# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PLOTTING ISOTHERMAL DIAGRAMS BY AN X-RAY DIFFRACTION METHOD
L. S. Moroz and V. V. Obukhovskii 11 Dec. 1971 16 p refs Transl. into ENGLISH from the monograph "Teoreticheskie i Eksperimentalnye Metody Issledovaniya Dyagramm Sostoyaniya Metallicheskikh Sistem" Moscow, 1969 p 252-259
(AD-739219; FTD-HT-23-1206-71) Avail: NTIS CSCL 11/6

A vacuum device for high temperature X-ray diffraction analysis is described (heating by A.C., sample heating velocity 100 degrees-sec., sample cooling rate 20 degrees-sec within 600-700 degrees, temperature changes of several degrees during the measurement, given residual pressure at 1000 degrees achieved within 1-1.5 hr., angular velocity one fourth-30 degrees-min., CsJ(Tl) crystal of a thickness of 0.8 mm, input 4kVA). Device parameters enable the plotting of isothermal diagrams of low alloyed Ti alloys. Isothermal diagrams of Ti4Al6Cr alloy and diagrams of isothermal decomposition of the metastable beta phase in Ti12V3Al, Ti6V4Al, Ti10V4Al, and Ti12V3Al alloys are given. Author (GRA)

N72-27587# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DIFFUSE SCATTERING OF X-RAYS BY A SOLID SOLUTION
A. V. Strelov and Ya. S. Umanskii 9 Dec. 1971 10 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met. (Moscow), v. 12, no. 9, 1969 p 125-128
(AF Proj. 7351)
(AD-739226; FTD-MT-24-941-71) Avail: NTIS CSCL 11/6

The diffuse scattering of X-rays by a solid solution of U-Mo is studied in the work. A structural diagram of the U-Mo composition according to the data of work is given. GRA

N72-27588# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
X-RAY STUDY OF THE THERMAL EXPANSION OF NICKEL-CHROMIUM ALLOYS
A. V. Progrushchenko 23 Dec. 1971 11 p refs Transl. into ENGLISH from Nauchn. Dokl. Vysshei Shkoy, Met. (Moscow), no. 1, 1958 p 218-221 csc 11/6
(AD-739301; FTD-MT-24-1603-71) Avail: NTIS

The peculiar features in the thermal expansion of the alloys being studied can be judged from the change in the crystal lattice parameter of the alloys with temperature. This is of interest in connection with the total number of peculiar features and anomalies in the temperature changes of such important characteristics as electrical resistance, heat capacity, and others. The purpose of this work is to present some experimental data obtained during X-ray study of the crystal lattice of nickel-chromium alloys at high temperatures. Author (GRA)

N72-27589# North American Rockwell Corp., Los Angeles, Calif.
MICROSTRUCTURES AND MECHANICAL PROPERTIES OF THERMOMECHANICALLY TREATED HIGH STRENGTH BETA TITANIUM
A. W. Sommer, L. A. Lee (Calif. Univ., Los Angeles), Kanji Ono (Calif. Univ., Los Angeles), and L. A. Rosales (Calif. Univ., Los Angeles) Feb. 1972 18 p refs
(Contract N00014-67-C-0439; NR Proj. 031-718)
(AD-739365; NA-72-232; TR-8) Avail: NTIS CSCL 11/6

Solution treated and water quenched beta titanium alloys, Beta-III (11.5Mo, 6 Zr, 4.5 SN) and a binary Ti-18% Mo alloy, were thermomechanically processed and their tensile properties determined as a function of prior treatment. Correlations of strength to internal structure were made utilizing thin film electron microscopy. Author (GRA)

N72-27590# Ohio State Univ., Columbus. Dept. of Metallurgical Engineering.
FUNDAMENTAL STUDIES OF DISSOLUTION AND PASSIVITY OF ALLOYS AND COMPOUNDS Report for 1 Mar. 1970 - 28 Feb. 1971
R. W. Satehle 28 Feb. 1971 96 p refs
(Contract N00014-67-A-0232-0006)

(AD-739395) Avail: NTIS CSCL 11/6

The work is concerned with the dissolution behavior of three materials in aqueous solutions: metallic oxides, iron base compounds, and metal alloys. During the first year, the significant literature was reviewed for the dissolution of the oxides and iron base compounds. A series of exploratory studies on the dissolution and oxides was also completed. A brief study of tubercle formation was conducted. Author (GRA)

N72-27591# Army Weapons Command, Rock Island, Ill. Weapons Lab.

EFFECT OF STRAIN RATE ON THE MECHANICAL PROPERTIES OF Cr-Mo-V STEEL AT ELEVATED TEMPERATURES

Kailasam R. Iyer Feb. 1972 24 p refs

(DA Proj. 1W5-62604-A-607)

(AD-739516; SWERR-TR-72-6) Avail: NTIS CSCL 11/6

The mechanical properties of quenched and tempered Cr-Mo-V steel were determined at temperatures between 800F and 1300F at strain rates ranging from 0.002 to 20/min. Experimental data were analyzed as functions of strain rate and temperature on the basis of three semi-empirical mechanical equations of state. Author (GRA)

N72-27592# Watervliet Arsenal, N.Y.

THE ROLE OF CARBIDE MORPHOLOGY ON LOW CYCLE FATIGUE BEHAVIOR OF IRON-CARBON ALLOYS

R. Vincent Milligan Feb. 1972 29 p refs

(DA Proj. 1To-62105-A-328)

(AD-739508; WVT-7203) Avail: NTIS CSCL 11/6

A series of iron-carbon binary alloys having a pearlitic and spheroidized microstructure were reverse cycled in a Uniaxial Tension-Compression mode. The carbon level varied from pure iron through four carbon levels up to 2%. The specimens had an hourglass shaped configuration. The diametral strain was measured and controlled with a ring-type LVDT. The diametral strain was converted and reported as longitudinal strain based on constancy of volume considerations. Total longitudinal strain range varied from 1% to 4%, giving cyclic lives in the region from 300-5,000. Increasing the carbon content significantly influenced the cyclic life for the pearlitic structure but had only a slight influence on the spheroidized material. Author (GRA)

N72-27593# North American Rockwell Corp., Los Angeles, Calif.

A STUDY OF DISLOCATION: HYDROGEN INTERACTION IN TITANIUM ALUMINUM ALLOYS VIA INTERNAL FRICTION MEASUREMENTS

P. P. Tung, A. W. Sommer, and K. Ono (Calif. Univ.) Mar. 1972 14 p refs

(Contract N00014-67-C-0439; NR Proj. 031-718)

(AD-739696; NA-72-273; TR-9) Avail: NTIS CSCL 11/6

Hydrogen-dislocation interactions in alpha titanium-aluminum alloys were studied via internal friction measurements in the temperature range 200K to 500K. Employing a series of titanium-aluminum binary alloys (0 %, 1 at. % and 3 at. %Al) these interactions were monitored in terms of observation of a damping peak which centers around 390 K at 10 MHz. The activation energy and attempt frequency of the damping peak in pure titanium were found to be 0.28 eV and 4x10 to the 10th power/sec, respectively. Both room temperature plastic deformation and the presence of hydrogen are required to generate this peak. The relaxation strength of the peak in each of the alloys increases at this peak. The relaxation strength of the peak in each of the alloys increases at low hydrogen levels with the square of hydrogen concentration and reaches a plateau when a critical hydrogen concentration is attained.

Author (GRA)

N72-27494 Welding Inst., Cambridge (England).

SOME METALLURGICAL FACTORS TO BE CONSIDERED FOR THE DESIGN AND FABRICATION OF EQUIPMENT EXPOSED TO HYDROGEN ENVIRONMENTS Conference Paper No. 3

H. T. Richardson (Bechtel Intern. Ltd.) *In its* Improving Welded Prod. Design, Vol. 1 1971 p 18-26 refs (For availability see N72-27491 18-15)

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18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N72-27594 National Lending Library for Science and Technology, Boston Spa (England).

SILICON, SILICON NITRIDE

L. N. Arkhangelskaya Apr. 1972 7 p refs Transl. into ENGLISH from Novye Dannye po Toksikologii Redkikh Metallov i ikh Soedinenii (Moscow), 1967 p 181-188

(NLL-RTS-7103) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.70; 2 NLL photocopy coupons

The application of macrocrystalline silicon in technology and precision engineering is considered. The physical and chemical properties of silicon and silicon nitride are discussed. Experiments were conducted in order to evaluate the effect of silicon and silicon nitride in the animal organism. Effects upon the general condition and body weight of rats, the state of blood circulation, serum protein concentration, and relative weight and morphology of the liver and lungs were analyzed. K.P.D.

N72-27595 National Lending Library for Science and Technology, Boston Spa (England).

INVESTIGATIONS INTO THE CHEMICAL HARDENING OF GLAZES

K. Grosskopf and H. Scholze 20 Apr. 1972 23 p refs Transl. into ENGLISH from Ber. Deut. Keram. Ges. (Bad Honnef/Rhein), v. 47, no. 9, 1970 p 556-562 In GERMAN and ENGLISH

(NLL-T-1509-(9022.305)) Avail: Natl. Lending Library, Boston, Spa, Engl.: 3 NLL photocopy coupons

By inducing ion exchange (K(+) for Na(+) in kno3 melts), below Tg, in six samples representing an intermediate stage between plate glass and a soft-porcelain glaze, compressive stresses were produced on the surface and their influence on the surface hardness was studied. The following properties were determined: the diffusion behavior, the development of stresses, the Knoop indentation hardness, and recovery and abrasion resistance. While the indentation hardness under load is only slightly influenced by ion exchange, the experimentally determined recovery increased with increasing ion exchange intensity. The latter is also associated with a decrease of abrasion losses, which generally betokens a favorable effect of chemical hardening on glaze surfaces. Author

N72-27596 National Lending Library for Science and Technology, Boston Spa (England).

HEAT RESISTANT COMPOSITE MATERIAL: NICHROME W FIBRE

V. F. Kotov, N. M. Fonshtein et al 4 Apr. 1972 9 p refs Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 8, 1971 p 20-22 In ENGLISH and RUSSIAN

(NLL-Trans-746-1148-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A Nichrome-base composite material, reinforced by tungsten fibers, was studied. The processes of fiber softening at prolonged elevated temperature were investigated by measuring microhardness changes. It was determined that an increase in the duration and temperature of tempering leads to a continuous decrease in microhardness. The study indicated that material of the Nichrome-tungsten-type has a long term stability. K.P.D.

N72-27597 National Lending Library for Science and Technology, Boston Spa (England).
NICHROME: MOLYBDENUM, TUNGSTEN COMPOSITE MATERIALS
F. P. Banas, V. V. Gaiduk et al 4 Apr. 1972 15 p refs Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 8, 1971 p 6-11 In ENGLISH and RUSSIAN
(NLL-Tras-746-1190-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Composites based on nickel-chromium alloys and reinforced by wires of refractory metals and their alloys were developed in the creation of heat-resistant materials. The methods of obtaining sheet composite materials are described. A vacuum method of shaping a metallic composite material during isothermal holding of a packet under a press was also used in the study. The matrix materials used were the heat-resistant Cr-78Ni-Ti (20% Cr, 78% Ni, 1% Fe) and 29% Cr-14% W-56% Ni alloys. A network of molybdenum and tungsten wire, 0.2 to 0.5 mm in diameter, was used for the reinforcing fibers. Author

N72-27598 National Lending Library for Science and Technology, Boston Spa (England).
ELECTRIC CONDUCTION IN GLASS
H. J. L. Trap 28 Mar. 1972 15 p refs Transl. into ENGLISH from NTZ-Nachrtech. Z. (W. Germany), v. 24, no. 7, Jul. 1971 p 353-360
(NLL-Trans-852-(9022.64)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Glasses are considered which can be used as working materials and which can be handled by the methods usual in glass technology. Semiconducting glasses are also discussed. The proof of electron conductivity in glass is presented. The preparation of electron-conducting oxide glasses is reviewed. The chalcogenide glasses and switching properties of amorphous substances are considered. The artificial production of electron conduction in glass and surface conductivity are also discussed.
K.P.D.

N72-27599 National Lending Library for Science and Technology, Boston Spa (England).
PROSPECTS FOR THE DEVELOPMENT OF FIBRE REINFORCED HIGH TEMPERATURE MATERIALS
G. Elssner 4 Apr. 1972 18 p refs Transl. into ENGLISH from z. Werkstofftechnik (West Germany), v. 2, 1971 p 337-345 in ENGLISH and GERMAN
(NLL-Trans-746-1195-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Applications of high temperature materials are discussed. The selection, mutual compatibility, and oxidation resistance of components are considered. Physical properties and methods of producing high temperature fiber composites are reviewed.
K.P.D.

N72-27600# Toulouse Univ. (France).
CONTRIBUTION TO THE STUDY OF BORON ATOM DIFFUSION IN SILICON Ph.D. Thesis
Jean Bodinaud 1972 145 p refs In FRENCH
(Publ-884) Avail: NTIS HC $9.25

The experimental apparatus is described which was used for the diffusion of impurities and the characterization of the coatings obtained. The diffusion equation and its integration for various hypotheses are discussed, as well as the analysis of possible methods of identifying parameters. The results are considered for experiments conducted by varying different parameters which would define a diffusion profile.
Transl. by K.P.D.

N72-27601# Aeronautical Research Labs., Melbourne (Australia).
THE EFFECT OF INTERFACIAL CARBIDE FORMATION ON FIBRE-STRENGTHENING IN CARBON-ALUMINIUM COMPOSITES
G. Blankenburgs Nov. 1971 28 p refs
(ARL/Met-87) Avail: NTIS HC $3.50

The effect of the formation of aluminum carbide on the mechanical properties of a model carbon-aluminum composite was investigated. The evidence shows that surface erosion of the fibers due to carbide formation reduces their cross section but does not reduce fiber strength by notch embrittlement. The formation of carbide also increases the effective interfacial shear strength between fibers and matrix. The decrease in strength of a composite which may result from the erosion of fiber cross section is compensated to some extent by an increase in interfacial shear strength. This compensation led to an observed maximum in the strength of composites annealed at various temperatures and times. The results suggest that the reaction between components of practical carbon-aluminum composites should not affect mechanical properties at services temperatures below 550 C. At higher temperatures, control of the reaction is necessary if interfacial shear strength is to be kept below the limits set by the matrix shear strength. Author

N72-27602# Explosives Research and Development Establishment, Waltham Abbey (England).
THE STORAGE LIFE OF FULLY COMPOUNDED RUBBER STOCKS. PART 1: INITIAL STUDIES
K. J. Ledbury, D. Sims, and A. L. Stokoe Apr. 1971 27 p refs
(ERDE-TR-44-Pt-1; BR26163) Avail: NTIS HC $3.50

Three fully compounded unvulcanized natural rubber mixes differing only in carbon black content were stored for periods of up to six months. The mixes were injection and compression molded, and the properties of the cured materials were compared. Instrumental and chemical methods were examined as aids to indicate changes occurring in the stored mixes. Oven storage on natural rubber and neoprene stocks also was carried out in an attempt to accelerate changes. Author (ESRO)

N72-27603# Fraunhofer-Gesellschaft zur Forderung der Angewandten Forschung e. V., Freiburg (West Germany). Inst. fuer Festkoerper Mechanik.
CORRELATION BETWEEN ABRASION, MICROINDENTATION HARDNESS, AND MAXIMUM FRACTURE VELOCITY FOR DIFFERENT OPTICAL GLASSES [ZUSAMMENHANG ZWISCHEN ABRIEB, MIKROEINDRUC-KHAERTE UND BRUCHHOECHSTGESCHWINDIGKEIT BEI VERSCHIEDENEN OPTISCHEN GLAESERN]
Frank Kerkhof and Martin Schinker Aug. 1971 28 p refs In GERMAN; ENGLISH summary
(WB-2/71) Avail: NTIS HC $3.50

The abrasion characteristics of fifteen different optical glasses of widely divergent properties were measured in different liquid environments. Maximum abrasion was observed when the environment was a solution of stearic acid in metaxylol. Next in order was distilled water. Least abrasion was noted in pure meta-xylol. Energy balances involved in brittle fracture were used to correlate abrasion characteristics to microindentation hardness and maximum fracture velocity. Author (ESRO)

N72-27604# McDonnell-Douglas Astronautics Co., Santa Monica, Calif.
MULTIAXIAL BEHAVIOR OF ATJ-S GRAPHITE Final Report, 1 Dec. 1970 - 15 Sep. 1971
Julius Jortner Wright-Patterson AFB, Ohio AFML Dec. 1971 201 p refs
(Contract F33615-71-C-1143; AF Proj. 7381)
(AD-739204; MDC-G2089; AFML-TR-71-253) Avail: NTIS CSCL 11/2

An experimental program to explore the fracture and stress-strain behavior of ATJ-S graphite under uniaxial, biaxial, and triaxial stresses is described. The program included the development of triaxial test techniques based on simultaneous pressurization and axial loading of solid and hollow cylindrical specimens. The experimental results include biaxial data obtained by simultaneous internal pressurization and axial loading of hollow cylindrical specimens at room temperature and 2000 F; uniaxial tensile and compressive data obtained at room

temperature in the with-grain and across-grain directions, and also at some off-axis angles; strains measured during hydrostatic pressurization to 20,000 psi at room temperatures; and triaxial data obtained by simultaneous external pressurization and axial loading of solid cylindrical specimens at room temperature.
Author (GRA)

N72-27605# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ABOUT THE FORMING OF THE STRUCTURE OF PYROLYTIC CARBONIC FIBERS
I. N. Ermolenko and R. N. Sviridova 12 Nov. 1971 11 p refs Transl. into ENGLISH from Vesti Akad. Navuk Belarusk. SSR, Ser. Khimichnykh Navuk (Minsk), no. 6, 1969 p 40-43
(AF Proj. 7343)
(AD-739284; FTD-MT-24-79-71) Avail: NTIS CSCL 11/5

Rayon fibers were oxidized with N oxides to poly (anhydrouronic acids) which were converted to the aluminum salts. The pyrolysis of fibers containing 11.5 percent COOH groups was carried out in a vacuum up to 850 degrees by raising the temperature at a 4 degrees minimum rate. Higher yields of carbon fibers with higher rigidity were obtained from rayons containing higher proportion of the COOH groups.
Author (GRA)

N72-27606# Naval Air Development Center, Warminster, Pa. Aero Materials Dept.
CORROSION INHIBITING PRIMERS FOR ALUMINUM ALLOYS
William C. Marshall 31 Dec. 1971 30 p refs
(AD-738446; NADC-MA-7164) Avail: NTIS CSCL 11/3

The epoxy primer conforming to specification MIL-P-23377B possesses corrosion inhibitory properties for aluminum superior to similar epoxy primers containing alizarin-strontium chromate, cadmium phosphate chromate, or chromium chromate as inhibitors.
Author (GRA)

N72-27607# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF DIAMOND BURNISHING ON THE QUALITY OF CHROMIUM COATINGS
A. F. Metelkin, L. A. Khvorostukhin, and V. N. Mashkov 20 Dec. 1971 10 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Mashinostr. (Moscow), no. 3, 1970 p 147-151
(AF Proj. 7343)
(AD-739206; FTD-HC-23-1736-71) Avail: NTIS CSCL 11/3

The features of diamond burnishing of a chromium-plated surface are examined. The interrelationship between burnishing modes and geometrical characteristics of surface quality have been established as a result of conducted experiments. Results of experimental work are presented for comparative tests on wear and contact fatigue of chromium-plated samples processed by diamond burnishing and polishing. It has been shown that diamond burnishing increases wear resistance and contact fatigue strength of chromium plating.
Author (GRA)

N72-27608# Artech Corp., Falls Church, Va.
RESEARCH ON WHISKER-REINFORCED METAL COMPOSITES Final Report, Jan. 1970 - Aug. 1971
Paul J. Lare, Fred Ordway, and Henry Hahn Dec. 1971 63 p refs
(Contract N00019-70-C-0205)
(AD-736973; J0012-FR) Avail: NTIS CSCL 11/4

The thermal stability of Al2O3 whiskers in a 2.5% Si-Al alloy matrix was investigated by heating composite samples to 370 C in air for exposure times up to 7500 hours. No significant deterioration in room temperature strength was observed after exposure. Processing of beta-SiC whiskers was improved to provide a cleaned and classified product. Use of hot pressing dies fitted with 1100 Al seals permitted the preparation of consistent composite and unreinforced matrix samples for investigating the susceptibility to stress corrosion of the 2024 Al/beta-SiC whisker composite system. Author (GRA)

N72-27609# Aerospace Corp., El Segundo, Calif. Lab. Operations.
THE APPLICATION OF A FRACTURE MECHANICS THEORY TO THERMAL SHOCK RESISTANCE OF BRITTLE MATERIALS Technical Report, Jan. - Aug. 1971
Ronald C. Rossi and D. P. H. Hasselman (Lehigh Univ.) 1 Apr. 1972 40 p refs
(Contract F04701-71-C-0172)
(AD-739494; TR-0172(2250-40)-6; SAMSO-TR-72-64) Avail: NTIS CSCL 11/2

A review is presented of a fracture-mechanics approach to thermal stress fracture of brittle solids. The theory assumes thermal stress fracture occurring under essentially a constant strain condition, and the results show that resistance to thermal shock is a function of physical parameters and initial flaw size. Implications of the theory are discussed and illustrated by experimental data and practical examples. Recommendations are made for the development of materials with superior thermal shock resistance.
Author (GRA)

N72-27610# Aerospace Corp., El Segundo, Calif. Lab. Operations.
PHOTOEMISSION FROM POLYMERS Technical Report, Nov. 1970 - Jun. 1971
Francis Hai and Melvin J. Bernstein 15 Mar. 1972 29 p refs
(Contract F04701-71-C-0172)
(AD-739498; TR-0172(2220-60)-2; SAMSO-TR-72-26) Avail: NTIS CSCL 11/9

An experimental study has been made of photoemission from several polymers, including polyethylene, kapton, teflon, and polyvinyl chloride, under irradiation by 15 to 25 keV photons. The emission intensities from these plastics were compared to those from several conductors, ranging from carbon to tantalum, and from other insulators such as glass and mica. For all these materials, the relative magnitude of photoemission was found to be mainly proportional to the photoelectric absorption coefficient. Under this pulsed irradiation, the insulators emitted as conductors when backed by conducting sheets but exhibited reduced emission associated with trapped charges when isolated.
Author (GRA)

N72-27611# North American Rockwell Corp., Thousand Oaks, Calif. Science Center.
A FEASIBILITY STUDY FOR THE CONTINUOUS AUTOMATED ANALYSIS AND CONTROL OF PHOSPHATIZING BATHS
Edward P. Parry and R. Lee Myers Rock Island, Ill. Army Weapons Command Feb. 1972 66 p refs
(Contract DAAF01-72-C-0130)
(AD-739510; SC523.1(ER); SWERR-TR-72-11) Avail: NTIS CSCL 11/3

The feasibility of automating production phosphate coating process baths were studied. The study comprised a detailed examination of the analysis and control requirements. Continuous automated analysis and control of phosphate baths are feasible. Analytical methods, sampling system procedures, and control logic techniques are presented for incorporation into a prototype system.
Author (GRA)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N72-27612 National Lending Library for Science and Technology, Boston Spa (England).

PARTICULAR SOLUTIONS OF THE LAPLACE TIDAL EQUATION

R. S. Shantuarov [1972] 6 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), no. 69, 1966 p 3-7 No diagrams, etc.; to be used in conjunction with original book

(NLL-M-22323-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A numerical method is proposed for the calculation of eigenvalues of the Laplace tidal equation in two particular cases: those of semidiurnal oscillations (G's method) and diurnal oscillations (the trial and error method). In the latter case, a more accurate solution can be obtained by combining the two methods. Galerkin's method and the trial and error method can also be used together, in cases such as oscillations with a period of 27 days and 11-year oscillations. Author

N72-27613 National Lending Library for Science and Technology, Boston Spa (England).

ON ESTIMATES OF THE BEST APPROXIMATION OF MANY-VARIABLE FUNCTIONS BY THE SUMS OF TWO FUNCTIONS OF LESSER NUMBERS OF VARIABLES

I. I. Ibrahimov and M-B. A. Babaev [1972] 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 201, no. 5, 1971 p 1037-1040 No diagrams, etc.; to be used in conjunction with original book

(NLL-M-22320-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The concept of a derivative with groups of variables is considered which is a development of the concept of a derivative with respect to direction. Methods for calculating it are given. Further, the Class Pe (lamda) sub kq is defined and, using a derivative with groups of variables, sufficient conditions are found for a many-variable-function belonging to this class. A method is presented for the calculation of the best approximation of the function f belonging to class Pi. Author

N72-27614 National Lending Library for Science and Technology, Boston Spa (England).

ASPECTS OF THE USE OF ORTHONORMAL EXPONENTIAL FUNCTIONS IN HYDROMETEOROLOGY

A. A. Dmitriev [1972] 6 p Transl. into ENGLISH from Proc. of All-Union Symp. of the Appl. of Statist. Methods in Meteorol. (Leningrad) p 89-94

(NLL-M-22459-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The use of orthogonal exponential functions as an approximation to differential laws of distribution is discussed. The mathematical limitations imposed upon a class of functions which can be approximated by this method are considered. K.P.D.

N72-27615 National Lending Library for Science and Technology, Boston Spa (England).

METHOD OF OBTAINING FIELDS OF PARTIAL DERIVATIVES BY THE METHOD OF MOIRE BANDS

P. I. Polukhin, V. F. Karishin, V. K. Vorontsev, A. B. Kudrin, and A. V. Pravdin [1972] 7 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Met. (Moscow), V. 1, 1972 p 66-68

(NLL-M-21376-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A method is proposed for obtaining partial derivatives of components of movement according to coordinates by the relative displacement of two copies of a deformation grid with minimum displacements. It is shown that the accuracy of the fields is increased by use of the method. The construction of frames is described for calculating partial derivatives by the proposed method. Author

N72-27616*# Scripta Technica, Inc., Washington, D.C.

SOME PROPERTIES OF HADAMARD MATRICES OF ORDER N EQUALS 2 TO THE mth AND THE REDUCTION OF SIGNAL REDUNDANCY BY USE OF DIGITAL FILTERS

G. Sh. Poltyryev NASA Dec. 1971 7 p refs Transl. into ENGLISH from Acad. Nauk SSSR (Leningrad), v. 1, 1970 p 518-526

(Contract NASw-2036)

(NASA-TT-F-13897) Avail: NTIS HC $3.00 CSCL 12A

An examination was made of the decomposition of a random sequence formed by discretization of a continuous stationary random process in terms of column vectors of a normalized Hadamard matrix. A number of properties of Hadamard matrices of an order $N = 2$ to the mth power, for $m = 1, 2, \ldots$, are proven. On the basis of these properties, certain properties of the variances of the outputs of the Hadamard filter were established. It is shown that the relative number of data at the output of the filter that ensure the necessary mean square error is independent of its dimensions for processes with a linear correlation function and depend only slightly on them for processes with a near-linear correlation function. It is also shown that, for processes with correlation function close to quadratic, the ratio of the number n of data at the output of the filter to the dimension of the filter N is, under certain conditions, $n/N = (1 + \log N)/N$. Author

N72-27617*# Translation Consultants, Ltd., Arlington, Va.

THE DIFFERENCE PROBLEM WITH AN OBLIQUE DERIVATIVE IN THE HALF PLANE

L. S. Frank and L. Ya. Shlyapochnik Washington NASA Jul. 1972 26 p refs Transl. into ENGLISH from "Raznostnaya Zadacha s Kosoy Proizvodnoy v Poluploskosti", Acap. of Sci. USSR, Moscow, report Pr-80, 1971 32 p

(Contract NASw-2038)

(NASA-TT-F-14346; Pr-80) Avail: NTIS HC $3.50 CSCL 12A

A class of approximations is distinguished for the problem with the oblique derivative in the plane when the degeneration is first order, and the dimensionality of the kernel of the problem is equal to 1. An algebraic condition is given for boundary operators necessary and sufficient for the stability of the approximation. D.L.G.

N72-27618# RAND Corp., Santa Monica, Calif.

PULSE PROCESSES ON SIGNED DIGRAPHS: A TOOL FOR ANALYZING ENERGY DEMAND

T. A. Brown, F. S. Roberts, and J. Spencer Mar. 1972 68 p refs

(Grant NSF GI-44)

(R-926-NSF) Avail: NTIS HC $5.50

The mathematical theory of predicting and controlling pulse processes in signed digraphs is considered. Basic definitions, in particular the notion of stability under a pulse process, are presented. Classical techniques of linear analysis, combined with structural information from the digraph itself, enable one to characterize the stability and general long-term behavior of a signed digraph under a pulse process. The theory of linear recursion sequences can be used to develop the theory of stability for a class of digraphs known as rosettes. Most of the results on signed digraphs apply to the more general concept of real-weighted digraphs. Author

N72-27619# National Aerospace Lab., Tokyo (Japan). Instrumentation and Control Div.

APPROXIMATION OF LINEAR OPERATOR SEMIGROUPS

Tadayasu Takahashi Feb. 1972 18 p refs

(NAL-TR-269T) Avail: NTIS HC $3.00

The approximation of an abstract Cauchy problem and the convergence of the approximation are discussed. Results on convergence of solution operators of Cauchy problems, and results on convergence of semigroups of bounded linear operators are presented, along with some variations. The notion of well-posedness of a Cauchy problem is considered, and the semi-discrete difference approximations of a Cauchy problem and their convergences are discussed. Author

N72-27620*# Texas Technological Univ., Lubbock. Dept. of Industrial Engineering.

SMOOTH EMPIRICAL BAYES ESTIMATION OF OBSERVATION ERROR VARIANCES IN LINEAR SYSTEMS Final Technical Report

H. F. Martz, Jr. and M. W. Lian 18 May 1972 8 p refs Submitted for publication

(Grant NGR-44-011-040)

(NASA-CR-127527) Avail: NTIS HC $3.00 CSCL 12A

A smooth empirical Bayes estimator was developed for estimating the unknown random scale component of each of a set of observation error variances. It is shown that the estimator possesses a smaller average squared error loss than other estimators for a discrete time linear system. Author

N72-27621# RAND Corp., Santa Monica, Calif.

UPPER BOUNDS FOR CONSTANT WEIGHT ERROR CORRECTING CODES

S. M. Johnson Mar. 1972 33 p refs

(Grant NSF GP-28862)

(R-916-1-NSF) Avail: NTIS HC $3.75

Upper bounds were developed for A (n, d), the maximum number of binary words of length n, each pair of words being at a Hamming distance of at least d apart. These sphere packing bounds for A(n, d) depend directly on a related bound for constant weight codes where each word has the same number of 1's . By combining special techniques from several sources, an upper bound for constant weight codes was developed in order to improve the bounds on A(n, d). Author

N72-27622# Maryland Univ., College Park. Center for Theoretical Physics.

SOLUTIONS OF THE BETHE-SALPETER EQUATION IN THE INFINITE-MOMENTUM LIMIT Ph.D. Thesis

Triptesh De and Y. S. Kim May 1972 26 p refs

(Grant NSF GP-8784)

(TR-72-111) Avail: NTIS HC $3.50

A method is presented for solving the O(3)-invariant integral equation obtained by taking the infinite momentum limit of the Bethe-Salpeter equation. A partial-wave decomposition was made for this O(3)-invariant integral equation. A variational method was developed to solve the resulting racial equation. The solutions give a mass coupling constant relation different from that of the solutions obtained by the conventional O(4) method. Author

N72-27623# Maryland Univ., College Park. Center for Theoretical Physics.

BETHE-SALPETER EQUATION IN THE INFINITE MOMENTUM LIMIT

Triptesh De and Y. S. Kim May 1972 6 p refs

(Grant NSF GP-8748)

(TR-72-101) Avail: NTIS HC $3.00

It is shown that the bound state Bethe-Salpeter equation becomes a two-dimensional Schrodinger-like equation in the infinite momentum limit. Author

N72-27624# Rome Univ. (Italy). Inst. of Physics.

THE SHADOW OPERATOR FORMALISM FOR CONFORMAL ALGEBRA. VACUUM EXPECTATION VALUES AND OPERATOR PRODUCTS

S. Ferrara (CNEN, Frascati, Italy), R. Gatto, A. F. Grillo (CNEN, Frascati, Italy), and G. Parisi (CNEN, Frascati, Italy) 29 Feb. 1972 11 p refs

(Nota-Interna-361) Avail: NTIS HC $3.00

A set of general properties of conformal covariant theories is presented. The formalism is entirely formulated in space-time and the requirement of conformal symmetry is simply achieved by adding to the Poincare algebra plus dilatation, a nonlinear discrete operation called coordinate inversion. The formalism allows for an easy derivation of two-point and three-point correlation functions. ESRO

N72-27625# Eidgenossische Technische Hochschule, Zurich (Switzerland).

CANONICAL SATELLITE THEORY BASED ON INDEPENDENT VARIABLES DIFFERENT FROM TIME

E. Stiefel, G. Scheifele, R. Kunz, N. Sigrist, and U. Kirchgraber Feb. 1972 162 p refs

(Contract ESOC-219/70/AR)

(ESRO-CR-(P)-76) Avail: NTIS HC $10.25

Analytical determination of the orbit of a satellite subjected to asphericity perturbations is presented with restriction to the zonal harmonics of the earth potential. Only canonical theories are considered, but have been widened by using independent variables other than physical time. The possible sets of the independent as well as the dependent canonical variables are discussed and compared. In particular the choice of the scaling function is investigated. ESRO

N72-27626# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

TABLES FOR THE EXTREME ROOTS OF THE WISHART MATRIX Final Report

D. S. Clemm, P. R. Krishnaiah, and V. B. Waikar Dec. 1971 28 p refs

(AF Proj. 7071)

(AD-739518; ARL-71-0264) Avail: NTIS CSCL 12/1

Let (1 sub 1) and (1 sub p) be respectively the smallest and largest roots of the central p x p Wishart matrix with n degrees of freedom. Tables are given for the exact values of U for p = 2(1)10 (2)20, alpha = 0.05, 0.025, 0.01, 0.005 and different values of n where P (U sup-1 < 1 sub 1 < 1 sub p < U) = (1-2 alpha). Also, exact lower 1%, 2.5%, 5%, 10% points of the distribution of (1 sub p) are given for p = 2 (1)10 (2)20 and for different values of n. Author (GRA)

N72-27627# Louisiana State Univ., Baton Rouge. Dept. of Electrical Engineering.

A COMBINED CORRELATION FUNCTION: LINEAR REGRESSION APPROACH TO SYSTEM IDENTIFICATION Ph.D. Thesis

J. Brian Froisy Dec. 1971 177 p refs

(Contract F44620-68-C-0021; AF Proj. 9749)

(AD-739525; AFOSR-72-0710TR) Avail: NTIS CSCL 12/1

The work presented in this dissertation is concerned with the problem of identifying the parameters describing a dynamic process based on an imput-output record of the process. The identification technique is used to approximate the parameters of a pulse transfer function and is structured for use in a sampled-data environment. System identification is not ordinarily an end in itself, but is rather a means of approaching an overall problem. The identification approach subsequently described is designed for use in an adaptive control configuration. Author (GRA)

N72-27628# Washington Univ., Seattle. Dept. of Mathematics.

INTERSECTING ALL EDGES OF CENTRALLY SYMMETRIC POLYHEDRA BY PLANES

Branko Gruenbaum Apr. 1972 14 p refs

(Contract N00014-67-A-0103-0003; NR Proj. 044-353)

(AD-739711; TR-32) Avail: NTIS CSCL 12/1

Motivated by information-theoretic problems, P. E. Oneil has recently investigated the question: how many hyperplanes are needed to cut all edges of an n-cube. A similar problem is investigated in this report, restricting the dimension but generalizing the class of polytopes. It is established that if P is a centrally symmetric convex polyhedron in 3-space then it is impossible to intersect all the edges of P by any pair of planes that miss the vertices of P. However, there exist convex 3-polytopes without a center of symmetry, as well as centrally symmetric tessellations of the 2-sphere, in which all edges may be intersected by a suitable pair of planes. Author (GRA)

N72-27629# California Univ., San Diego. Dept. of Mathematics.
MARKOV PROCESSES AND RELATED TOPICS Final Status Report, 1 Feb. 1967 - 31 Jan. 1972
Ronald K. Getoor 24 Feb. 1972 6 p refs
(Grant AF-AFOSR-1261-67; AF Proj. 9749)
(AD-739983; AFOSR-72-0742TR) Avail: NTIS CSCL 12/1

The main part of the report consists of a description of thirteen research papers and one book covering the following areas: Limit theorems, equilibrium potentials, Markov processes, additive functionals, dual processes, Levy systems, regularity of excessive functions, and potential theory. The book is considered to be the standard reference in the field of Markov processes and potential theory. Author (GRA)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N72-27630 National Lending Library for Science and Technology, Boston Spa (England).
RELATION BETWEEN RADIATION INVERSIONS AT NIGHT AND THE DIURNAL RANGE OF AIR TEMPERATURE
N. A. Lazareva and T. A. Kurpakova [1971] 8 p refs Transl. into ENGLISH from Glav. Geofiz. Obs. (Leningrad), v. 265, 1970 p 138-144 No diagrams, etc. to be used in conjunction with original paper
(NLL-M-22336-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

The dependence of the amount of inversion in degrees and the depth of the inversion at night on the diurnal range of air temperature at a height of 2 m in different geographical regions of the USSR is examined. Charts are given showing the distribution of the mean values of intensity and thickness of surface inversions during the warm period of May through August. Author

N72-27631 National Lending Library for Science and Technology, Boston Spa (England).
WAYS OF REALISING A SYSTEM FOR THE AUTOMATION OF THE COLLECTION, ANALYSIS, PROCESSING AND DISSEMINATION OF OPERATIONAL AGROMETEOROLOGICAL INFORMATION
A. G. Novikov [1972] 17 p refs Transl. into ENGLISH from Tr. Nauchn.-Issled. Cent. SSSR, Gidromet. (Leningrad), v. 69, 1970 p 76-90
(NLL-M-22337-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The operational application of automatic systems to collecting, analyzing, processing, and dissemination of agrometeorological information is discussed along with the requirements for coding data suitable for computer processing. A stage-bystage plan is for automation developed which incorporates the computerized hydromet centers. F.O.S.

N72-27632* National Aeronautics and Space Administration, Washington, D.C.
ENVIRONMENTAL STATEMENT FOR THE GLOBAL ATMOSPHERIC RESEARCH PROGRAM Draft Environmental Impact Statement.
Mar. 1971 5 p
(NASA-TM-X-68546) Avail: NASA Public Document Rooms, $1.00 CSCL 04A

The GARP program and objectives are briefly outlined and the potential use of GARP data on changes in weather conditions in making decisions for environmental pollution control is mentioned. It is concluded that no detrimental environmental impact results from the launches of the vehicles ranging in size from the Scout to the Titan 3C launch vehicles. No alternatives to the proposed action are deemed of value, no commitments of natural resources are involved, and the program has potential for long range weather predictions. N.E.N.

N72-27633 Freie Univ., Berlin (West Germany).
METEOROLOGICAL DATA. VOLUME 124, NO. 1: DAILY ALTITUDE MAPS OF THE 30 mb LEVEL AS WELL AS MONTHLY MEAN MAPS FOR 1971, PART 1 [METEOROLOGISCHE ABHANDLUNGEN. BAND 124, HEF 1: TAGLICHE HOHENKARTEN DER 30-mb-FLAECHE SOWIE MONATLICH MITTELKARTEN FUER DAS JAHR 1971, TEIL 1]
1971 114 p In GERMAN; ENGLISH summary
(QR-1-Pt-1) Avail: Issuing Activity

The present volume continues the series of stratospheric weather maps published since 1957 in the Meteorologische Abhandlungen of the Meteorological Institute of the Free University. It contains daily height and temperature analysis of constant pressure levels for three months for the entire Northern Hemisphere, based on rawinsonde and rocketsonde data. The analysis is performed with the aid of a hydrostatic build-up method. The corresponding monthly mean maps, their variations and deviations are included as well as the mean gridpoint data, calculated from daily values. The stratospheric circulation of polar, middle, and tropical latitudes is described for the period under consideration. Author

N72-27634 National Lending Library for Science and Technology, Boston Spa (England).
SOME REMARKS ON THE USE OF SCALE ANALYSIS IN DYNAMIC METEOROLOGY
I. Jacobsen [1972] 86 p refs Transl. into ENGLISH of a book published by Freie Univ., Berlin, 1968 102 p
(NLL-M-22384-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 9 NLL photocopy coupons

Certain aspects are presented of scale analysis with consideration of the filtering and approximation of the hydrothermodynamical equations for different meteorological scales. The proposed definitions, formulated in the language of the topology of solution spaces for systems of equations, point to connections between the elimination of noise processes and the parametrization of these phenomena in approximations, and give rise to questions and problems which must be considered in any approximation theory. An account of the method of scale analysis is followed by a discussion of its possibilities and limitations, both of which have their origin in the same fact, that scale analysis approximates the differential equations algebraically. Three typical samples show the applications of scale analysis. The large-scale development of the weather in middle and high latitudes, and where there is little convection in equatorial regions, is an example of uniform behaviour (gradients of the same order of magnitude throughout) with little interaction between the different scales. Derivation of dimensionless forms of the hydrothermodynamical equations in terms of the Burger and Rossby numbers leads, on the large scale, to the quasi-geostrophic system as a first approximation and the balance equation system as a second; on the planetary scale, filtering of noise processes is only possible in the geostrophic model, which is like that in the Ekman theory because of its friction terms. Author

N72-27635 Deutscher Wetterdienst, Offenbach am Main (West Germany).
LOCAL CLIMATOLOGICAL STUDIES IN THE ODEN FOREST [LOKALKLIMATISCHE STUDIEN IM ODENWALD]
Fritz Schnelle 1972 39 p refs In GERMAN; ENGLISH summary
(Rept-128) Avail: Issuing Activity

Meteorological observations taken by a network of weather stations in the Odenwald area of Germany are discussed. The variation of the maximum and minimum temperatures have been studied which are tyical for hills and due to different situations

on tops of hills and bottoms of valleys. Registrations of temperature and atmospheric humidity at four stations made it possible to study the diurnal variation and the annual course of the diurnal variation of the air temperature in case of extreme radiation weather. Author

N72-27636 Deutscher Wetterdienst, Offenbach am Main (West Germany).
SYNOPTICS AND ENERGENICS FROM HAMBURG TIDAL STORM WEATHER STATION DURING FEBRUARY 1962. ENERGY BUDGET EQUATIONS, SYNOPTIC ANALYSIS AND WIND FIELD CALCULATIONS [SYNOPTIK UND ENERGETIK DER HAMBURGER STURMFLUTWETTERLAGE VOM FEBRUAR 1962. ENERGETISCHE HAUSHALTSGLEICHUNGEN, SYNOPTISCHE ANALYSE UND BERECHNUNG DES WINDFELDES]
Fr. Defant, H. Fechner, and P. Speth 1972 86 p refs In GERMAN; ENGLISH summary
(Rept-127) Avail: Issuing Activity

The results of an extensive synoptic study of the atmosphere above the Atlantic Ocean and Europe from 14 to 17 February 1962 are presented. The results of a quantitative evaluation of the synoptic material in order to obtain an insight into the energetics of the weather conditions are examined. The budget equations for the available potential and kinetic energy are examined. Principles are presented by which the field of horizontal wind is obtained from considerations of surface topography, surface friction, and turbulence in the free atmosphere. Author

N72-27637 National Lending Library for Science and Technology, Boston Spa (England).
RELATION BETWEEN THE DATE OF THE TRANSITION FROM SUMMER TO EARLY AUTUMN IN THE FUKUOKA AREA AND THE TEMPERATURES OF THE KYUSHU DISTRICT IN THE FOLLOWING WINTER
Toiziro Fukatani [1972] 11 p refs Transl. into ENGLISH from J. of Meteorol. Res. (Japan), v. 22, 1970 p 525-535
(NLL-M-22196-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The correlation between date of transition to early autumn in Fukuoka with the temperature the following winter in Kyushu, and the relationship between the transition date and the pressure changes in the stratosphere and troposphere were investigated. It was found that there is a tendency towards warm winters following early transition dates and cold winters following late dates. The date the easterlies at the 100 mb level reverse to become westerlies is approximately the date of transition to early autumn. The differences between pressure distributions around the transition date, and the changes of pressure distributions in cold and warm winters are discussed. It is thought that the variation of middle stratospheric circulation during the summer-autumn transition has the closest relationship with the pressure distribution in the following cold or warm winter. N.E.N.

N72-27638 National Lending Library for Science and Technology, Boston Spa (England).
METEOROLOGICAL ASSISTANCE FOR THE CONCORDE TRIAL FLIGHTS
Henri Robert Cazale [1972] 17 p refs Transl. into ENGLISH from the publ. "French/American Meteorological Societies' Joint Meeting" Paris, 1971 p 1-19
(NLL-M-22439-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Eng.: 2 NLL photocopy coupons

The weather predictions for the Concorde test flights are discussed for the prototype and first subsonic flights in the lower atmospheric layers, the subsonic and transonic flights at altitudes between 500 and 200 mb, and the supersonic flights reaching to 100 mb and at a speed of Mach 2. The problems of predicting clear air turbulence and of predicting temperatures at 100 mb and 70 mb with sufficient fine detail and accuracy are described. The general conclusion is that meteorological help has played an important role in successive phases of the SST tests, and that increasing meteorological assistance will be requested. N.E.N.

N72-27639 National Lending Library for Science and Technology, Boston Spa (England).
AN EXAMPLE OF A COLD FRONT MOVING SOUTH IN THE JAPAN SEA IN AUTUMN
Keiji Harami [1972] 10 p Transl. into ENGLISH from Fune to Kaijo Kisho (Japan), v. 14, no. 3, 1970 p 4-8 No diagrams, etc.; to be used in conjunction with original book
(NLL-M-22454-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The passage of a cold front, which was trailing an instability line, over the Sea of Japan is analyzed from meteorological data supplied by five weather ships and a buoyed robot. The synoptic conditions for the surface and the 500 mb level are described along with the weather changes. It is concluded that the usual cold front in weather charts and fishing broadcasts is, in fact, an instability line, and the true cold front is considerably delayed. F.O.S.

N72-27640*# Scientific Translation Service, Santa Barbara, Calif.
HUMIDITY MEASUREMENT BY MEANS OF INFRARED REFLECTION
K. Hoffman Washington NASA Jun. 1972 27 p refs Transl. into ENGLISH from Chem.-Ing.-Tech. (Weinheim), v. 35, no. 1, 1963 p 55-62
(Contract NASw-2035)
(NASA-TT-F-14333) Avail: NTIS HC $3.50 CSCL 04B

The effect of water absorption on infrared reflection is used as a means of continuous humidity measurement. For this purpose, the intensities at a measured wavelength of 1.93 microns are compared with those of a comparison wavelength of 1.7 microns. At the wavelength 1.93 microns, there is a large amount of absorption. At the comparison wavelength 1.7 microns, there is only a small amount of absorption. The dependence of the reflection on the water content is studied using numerous spectral curves. In agreement with the theory, one finds that the optical humidity measurement is especially sensitive to small absolute humidity contents. In addition, the influences of various parameters such as particle size, variable basic absorption and layer thickness on the measurement method are discussed. The application possibilities and limitations of the method are discussed. Author

N72-27641# National Environmental Satellite Service, Washington, D.C.
A TECHNIQUE FOR THE ANALYSIS AND FORECASTING OF TROPICAL CYCLONE INTENSITIES FROM SATELLITE PICTURES
Vernon F. Dvorak Jun. 1972 19 p
(NOAA-TM-NESS-36) Avail: NTIS HC $3.00

A technique for using satellite pictures to analyze tropical cyclones is described in detail. Specific instructions are given for detecting changes in cyclone intensity, for estimating the magnitude of the intensity, and for forecasting 24-hour intensity changes. A code for transmitting this information is also described. Author

N72-27642*# Translation Consultants, Ltd., Arlington, Va.
AIR IONIZATION MEASUREMENTS IN DIFFERENT METEOROLOGICAL AND ENVIRONMENTAL CONDITIONS
R. Ferrara and G. Tonna NASA Washington Apr. 1972 8 p refs Transl. into ENGLISH of "Misure di ionizzazione dell'aria in differenti condizioni meteorologiche ambientali', Rept. IFA-CP-226 Natl. Council of Res., Inst. of Atmospheric Phys., Naples, Oct. 1969 10 p Presented at 18th Meeting of the Italian Geophys. Assoc., Naples, Oct. 1969
(Contract NASw-2038)
(NASA-TT-F-14408; IFA-CP-226) Avail: NTIS HC $3.00 CSCL

04B

The concentrations of small positive and negative ions in the air were measured in open country, at a polluted site, in fog, and in an artificially conditioned environment. Concentrations of atmospheric aerosols, which capture the small ions, were also measured. Two identical Gerdien condensors were connected to two Keithley model 610 B electrometers, which were in turn connected by an integrated circuit to two paper recorders. The number of ions-cu cm and the extinction coefficient are graphed as a function of the time of day. N.E.N.

N72-27643# Chicago Univ., Ill. Cloud Physics Lab.
A DIFFUSION MODEL OF RAPID GLACIATION WITHIN SUPERCOOLED CLOUDS
Ken Young May 1972 52 p refs
(Grants NSF GA-28190X; NSF GA-20470)
(TN-42) Avail: NTIS HC $4.75

A microphysical model is developed to study precipitation resulting from artificial modification of layer-type orographic clouds. Glaciation times are found to be significantly more rapid for large ice crystal concentrations, colder ambient temperatures, and lower liquid water content, slightly more rapid for lower pressures and clouds having higher drop concentrations, and the dependence of glaciation parameters on the updraft velocity is negligible. Glaciation initiated in moderately strong updrafts (2 m/sec or more) produce a significantly higher concentration of ice crystals for a given ice nucleus activity spectrum. This would suggest that to produce rapid glaciation, the nucleating agent must be introduced rapidly into the cloud at the temperature which will activate the desired number of nuclei. Concentrations of activated ice nuclei in excess of 10 per cu cm are sufficient to glaciate virtually any supercooled cloud within 4 min. A glaciation time of 480 sec is predicted using an ice crystal concentration of 1 per cu cm in monodispersed cloud containing 300 drops per cu cm at -20 C and 800 mb with an updraft of 1 m/sec. Author

N72-27644# Chicago Univ., Ill. Cloud Physics Lab.
SYSTEMATIC MEASUREMENTS OF CLOUD PARTICLE SPECTRA IN MIDDLE LEVEL CLOUDS
Paul Spyers-Duran 31 May 1972 60 p refs
(Grants NSF GA-20470; NSF GA-28190X)
(TN-43) Avail: NTIS HC $5.00

Altostraus, altocumulus, and middle level accessory clouds were studied with airborne continuous replicators. Altostratus opacus clouds consisted entirely of supercooled droplets, with average drop concentrations between 98 and 177 per cu cm, the mean radius between 5.3 and 8 microns, and the volume mean radius between 5.6 to 8.8 microns, and liquid water content (LWC) from 0.1 to 0.4 g/cu m. Altocumulus castellanus clouds are characterized by fairly strong vertical motions; their composition varies from all super-cooled water droplets to a mixed phase, mean radius from 3.7 to 4.3 microns, the volume mean radius from 4.7 to 5.5 microns, average concentrations up to 2170 drops per cu cm, and LWC 1.3 g/cu m. Altocumulus cumulogenitus clouds show mixed phase composition, mean radii for the cloud droplets between 4.4 and 6.9 microns, and volume mean radii between 5.3 to 9.7 microns, the drop concentrations less than 200 per cu cm, and LWC 0.1 to 0.6 g/cu m. The Pileus cloud consisted of supercooled droplets entirely, with mean radius of 5.5 microns, average concentration of 78 per cu cm, and LWC less than 0.1 g/cu m. The Velum cloud showed similar values. Author

N72-27645*# Chicago Univ., Ill. Cloud Physics Lab.
ICE CRYSTAL TERMINAL VELOCITIES
Andrew Heymsfield Apr. 1972 41 p refs
(Grants NGR-14-001-148; NSF GA-28190X; NSF GA-20470; NSF GA-11088)
(NASA-CR-127428; TN-41) Avail: NTIS HC $4.25 CSCL 04B

Terminal velocities of different ice crystal forms were calculated using the most recent ice crystal drag coefficients, aspect ratios, and densities. The equations derived were primarily for use in calculating precipitation rates by sampling particles with an aircraft in cirrus clouds, and determining particle size in cirrus clouds by Doppler radar. However, the equations are sufficiently general for determining particle terminal velocity at any altitude, and most any crystal type. Two sets of equations were derived. The general equations provide a good estimate of terminal velocities at any altitudzj The specific equations are a set of equations for ice crystal terminal velocities at 1000 mb. The calculations are in good agreement with terminal velocity measurements. The results from the present study were also compared to prior calculations by others and seem to give more reasonable results, particularly at higher altitudes. Author

N72-27646*# Wisconsin Univ., Madison. Space Science and Engineering Center.
METEOROLOGICAL MEASUREMENTS FROM SATELLITE PLATFORMS Annual Scientific Report, 1970 - 1971
Verner E. Suomi Feb. 1972 262 p refs
(Contract NAS5-11542)
(NASA-CR-122437) Avail: NTIS HC $15.25 CSCL 04B

The use of ATS pictures for meteorology and various satellite-borne instruments are considered. For individual titles, see N72-27647 through N72-27652.

N72-27647* Wisconsin Univ., Madison. Space Science and Engineering Center.
WINDCO: AN INTERACTIVE SYSTEM FOR OBTAINING ACCURATE CLOUD MOTIONS FROM GEOSTATIONARY SATELLITE SPIN SCAN CAMERA PICTURES
Eric Smith and Dennis Phillips *In its* Meteorol. Meas. from Satellite Platforms Feb. 1972 p 1-51 refs (For availability see N72-27646 18-20)
CSCL 04B

An interactive man-computer system called WINDCO was developed to measure cloud motion from ATS pictures. This system is capable of providing cloud motion measurement accuracy to better than 2.5 knots (1.2 m/sec) rms at moderate cost in a real-time environment. The problem of precise picture alignment was solved with an analytic solution, called ATS navigation, which is capable of aligning consecutive ATS digital pictures to within one nautical mile. Three days during the Barbados oceanographic and meteorological experiment in July 1969 were selected for a case study. On each day cloud motion vectors were computed over three time intervals. The repeated measurements of cloud motion vectors indicate that the east-west and north-south components are reproducible within 1.0 knot (0.5 m/sec) and 20 knots (10 m/sec), respectively. Author

N72-27648* Wisconsin Univ., Madison. Space Science and Engineering Center.
ATS-3 OBSERVED CLOUD BRIGHTNESS FIELD RELATED TO MESO- TO SUBSYNOPTIC-SCALE RAINFALL PATTERN
D. N. Sikdar *In its* Meteorol. Meas. from Satellite Platforms Feb. 1972 p 53-76 refs (For availability see N72-27646 18-20)
CSCL 04B

The geosynchronous satellite ATS 3 time lapse cloud brightness data were analyzed with a view to correlating the time variations of cirrus shield area to rainfall rate in midlatitude storm complexes. Correlation was obtained with the time change of radar echo areas in the cloud complex. Preliminary results are presented on correspondence between subsynoptic scale cloud brightness anomaly patterns and the precipitation patterns in mid latitude frontal zones. Author

N72-27649* Wisconsin Univ., Madison. Space Science and Engineering Center.
CLOUD PHOTOGRAPHS FROM SATELLITES AS A HYDROLOGICAL TOOL IN REMOTE TROPICAL REGIONS
Ronald C. Grosh *In its* Meteorol. Meas. from Satellite Platforms Feb. 1972 p 77-124 refs Supported in part by NSF and by

Fund. de Amparo a Pesquisa do Estado de Sao Paulo (For availability see N72-27646 18-20)
CSCL 04B

A relationship was sought between brightness measurements obtained from the high resolution camera of an Applied Technology Satellite and rainfall and runoff measured on the ground. Surinam was chosen as a site for this experiment for three reasons: (1) rain is abundant during June and July; (2) it was in the center of the ATS 3 picture and therefore navigation was simplified; and (3) it is a country with relatively inaccessible areas and it would be able to benefit from the practical results of such research. The data were to be collected during June and July, the end of the major Surinam rainy season. Because the satellite data had to be recorded on magnetic tape, only a short period of data gathering was available. Author

N72-27650* Wisconsin Univ., Madison. Space Science and Engineering Center.
DESIGN OF A SMALL RADAR ALTIMETER FOR BALLOON PAYLOADS
Ferrel G. Stremler, Charles D. Blair, and Robert A. Oehikers *In its* Meteorol. Meas. from Satellite Platforms Feb. 1972 p 125-139 refs (For availability see N72-27646 18-20)
CSCL 04B

The radar altimeter design was intended primarily for high altitude balloon flights. It permits one to make geometric altitude measurements up to 35 km over water and 13 km over land to an accuracy of 0.03%. Minimum altitude for operation is 2 km, although this can be extended down another kilometer by readjustment of circuit parameters. Range ambiguity is equal to the minimum range of the device. The complete altimeter, excluding power source, weights less than 100 grams. It is designed to operate at temperatures down to -55 C and to be nonhazardous to aircraft. A schematic diagram of an altimeter which operates at 400 MHz is shown. Test results using this design are given. Author

N72-27651* Wisconsin Univ., Madison. Space Science and Engineering Center.
AVERAGED PULSE SHAPE MEASUREMENTS OF RADAR SEA RETURN AT NEAR-VERTICAL INCIDENCE
Nadav Levanon *In its* Meteorol. Meas. from Satellite Platforms Feb. 1972 p 140-165 refs (For availability see N72-27646 18-20)
CSCL 04B

Measurements of pulse shape were made at a 75 cm wavelength, from light aircraft flying at altitudes of 2 km to 2.3 km over various water surfaces. Both specular and scattered reflections were observed in all the returns, with clear distinction between the two components. Dominance by either the specular or the scattered component was observed, the former being more frequent. Real-time averaging was obtained by utilizing a sampling technique. This enabled a reduction of the system bandwidth to several hertzs, allowing the use of low peak power RF pulses (I W), and low speed chart recorders. Twenty-one recorded average returns are given, along with an interpretation of the recordings, and a description of the measuring system. Author

N72-27652* Wisconsin Univ., Madison. Space Science and Engineering Center.
PROPERTIES OF TROPICAL CLOUD CLUSTERS DETERMINED FROM GEOSTATIONARY SATELLITE PICTURES Ph.D. Thesis
Arthur Frederick Hasler *In its* Meteorol. Meas. from Satellite Platforms Feb. 1972 p 166-270 refs (For availability see N72-27646 18-20)
CSCL 04B

The use of geostationary satellite pictures for observations concerning tropical convective ensembles or cloud clusters is considered. A close-up time lapse movie technique was developed with which cloud trajectories were measured from a geostationary satellite with 1.5 meters/second accuracy at better than synoptic scale resolution for low clouds over tropical oceans. A polygon technique was developed to measure the divergence and vorticity of the synoptic scale cloud trajectory field. Planimeter and polygon measurements of the cirrus shield expansion were used to estimate the high level divergence. Author

N72-27653# Istituto di Fisica Dell Atmosfera, Rome (Italy).
COMPILATION OF THE 1970 ANNUAL DATA FROM MEASUREMENTS OF THE TOTAL BETA ACTIVITY DETERMINED FROM ATMOSPHERIC DUST SAMPLES COLLECTED IN ITALY BY AM-CNR GROUND STATION NETWORK [1970 ELABORAZIONE ANNUALE DEI DATI DI MISURA DELL'ATTIVITA BETA TOTALE RILEVATA SUI CAMPIONI DI PULVISCOLO ATMOSFERICO PRELEVATI IN ITALIA DALLE STAZIONI DELLA RETE AM-CNR]
B. Pavesi and E. Dietrich (Aeron. Mil. Ital.) 1971 57 p In ITALIAN Prepared jointly with Aeron Mil. Ital.
Avail: NTIS HC $5.00

The 1970 annual data obtained from total beta activity measurements in atmospheric dust samples collected in Italy by 19 Aeronautical Militare (AM) stations and nine Consiglio Nazionale delle Ricerche (CNR) ground stations are compiled. Two samples per day were collected during twelve hours from the AM stations. One sample per day was collected during 24 hours from the CNR network. ESRO

N72-27654# Naval Weapons Center, China Lake, Calif.
A SOLUTION OF THE SPHERICAL DIFFUSION EQUATION AND ITS APPLICATION TO NUCLEATING PARTICLE LIFETIMES
R. J. Stirton Jan. 1972 31 p refs
(AD-739323; NWC-TP-5294) Avail: NTIS CSCL 04/2

The dissolution of a spherical particle in a spherical water drop is governed by the radial diffusion equation provided the predominate transport process is diffusion. The boundary conditions are no flow through the water-drop surface and a saturated solution of the particle material at the particle-water interface. The initial condition is an arbitrary radial distribution of concentration. Since the particle radius is shrinking, the inner boundary condition is time dependent. However, instead of attempting the solution with a moving boundary, the concept of a fixed, effective particle radius is introduced. With these boundary and initial conditions, an infinite series solution to the diffusion equation is found by the Laplace transform technique. The particle lifetime is found by using this solution of the diffusion equation to determine the time at which the particle has just completely dissolved. Curves of lifetimes as functions of solubility and particle and drop radii are given. Author (GRA)

N72-27655# Iowa Inst. of Hydraulic Research, Iowa City.
OLD GOLD MODEL, TYPE 4-2H HOT-WIRE ANEMOMETER AND TYPE 2 MEAN-PRODUCT COMPUTER
John R. Glover Jan. 1972 33 p refs Supersedes IIHR-105 (Contract Nonr-1509(03))
(AD-739337; IIHR-136) Avail: NTIS CSCL 04/2

A two-channel constant-temperature hot-wire anemometer and mean-product computer are described. The anemometer section of the instrument generates linear signals proportional to the instantaneous components of the velocity. The signals are processed by the mean-product computer which is a complete analog multiplier for computing the product of two signals. Included with the mean-product computer is an integrating analog-to-frequency converter which when connected to an electronic counter gives a digital display of the mean product. Operating procedures, instrument calibration, and circuit descriptions are presented to aid in the application of hot-wire anemometry for measuring flow velocities. Author (GRA)

N72-27656# Naval Postgraduate School, Monterey, Calif.
REGRESSION METHODS IN FIVE DAY MEAN HEIGHT PREDICTION AT 500 MB USING MEAN NIMBUS 2 COMPOSITED INFRARED DATA FOR IDENTICAL PERIODS

IN THE UPDATE PROCEDURE
Frank L. Martin 31 Mar. 1972 33 p refs
(AD-739358; NPS-51MR720301A) Avail: NTIS CSCL 04/2

A series of 15 successive 5-day mean 500 mb height fields in gridprint form covering the quasi-hemispheric area between 14.8 - 70.2 N latitude was used in this experiment. The time period extended between 15 May 1966 through 28 July 1966. The stepwise regression procedure was employed to derive statistical estimator equations for each mean map field Z (5) (I,J,t+1) in terms of the preceding field data Z(5) (I,J,t) as the primary predictor, (t+1 + 2, ..., 15). As additional predictors, the 5-day mean composited gridpoint values of the N 2 MRIR equivalent black body temperatures in the water-vapor channel (denoted T (1)) and the window channel (denoted T (2)) were introduced for both analyses times t(1) and t+1. The five-predictor regression equations thus developed for Z(5) (I,J,t+1) proved to have substantial statistical significance, both from the standpoint of the specification and of prediction of Z(5) (I,J,t+2) valid five days later (t+2 = 3, ..., 15). Author (GRA)

N72-27657# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ONE METHOD OF SOLVING EQUATIONS OF HYDROTHERMODYNAMICS
V. I. Gubin and R. Tillyashaikhova 15 Dec. 1971 8 p refs Transl. into ENGLISH from izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk (Tashkent), v. 13, no. 5, 1969 p 7-9
(AD-739239; FTD-HT-23-1338-71) Avail: NTIS CSCL 04/2

A description is given of a procedure for solving a class of hydrothermodynamic equations used in forecasting meteorological elements. The equations of motion involved are assumed to be quasi-linear and are reduced to a system of ordinary differential equations. Wind velocity components can be determined as functions of the pressure field by using this procedure.
Author (GRA)

N72-27658# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE QUESTION OF THE CONNECTION BETWEEN THE TURBULENCE COEFFICIENT AND TEMPERATURE AND WIND DISTRIBUTION IN THE LOWER 300 METER LAYER
V. G. Voloshin 15 Dec. 1971 11 p refs Transl. into ENGLISH from Meteorol. Klimatologiya i Gidrolog. Mezhduved. Nauchnyi Sb. (USSR), no. 5, 1969 p 90-94
(AD-739221; FTD-HT-23-1200-71) Avail: NTIS CSCL 04/2

In a number of works the dependence of the value of the turbulence coefficient on the peculiarities of vertical wind and temperature distribution in the lower boundary layer has been found in the form of dimensionless functions. In this paper the dimensionless function F(B) was found from data of observations on the 300-meter mast of the Institute of Applied Geophysics.
GRA

N72-27659# Israel Program for Scientific Translations, Ltd., Jerusalem.
COMPUTER PROCESSING OF METEOROLOGICAL DATA
S. L. Belousov, L. S. Gandin, and S. A. Mashkovich 1971 217 p refs Transl. into ENGLISH of the publ. "Obrabotka operativnoi meteorologicheskoi informatsii, s pomoshch'yu elektronnykh vychislitel'nykh mashin" Leningrad, Gidrometeorol., 1968 217 p Sponsored by NOAA and NSF
(TT-70-50185) Avail: NTIS HC $3.00 CSCL 04B

Data cover the following: Initial computer processing of meteorological data; theoretical foundations of objective analysis of meteorological fields; objective analysis methods and their application under operational conditions; objective analysis for data-sparse areas; and automatic data processing in numerical weather forecasting. GRA

N72-27660# Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
CONVECTIVE HEAT AND MASS TRANSFER FROM WATER SURFACES
J. Taylor Beard, Charles S. Chen, and Chandrika Prasad Nov. 1971 37 p refs Prepared in cooperation with Va. Univ., Charlottesville
(Grant OWRR-B-021-VA(3))
(PB-207638; VPI-WRRC-Bull-47) Avail: NTIS HC $3.00 CSCL 04B

Analog computer-methods were used to study convective heat and mass transfer between horizontal flows of air and surface. Solutions of the laminar boundary layer equations for both the gaseous and liquid phases were developed. Profiles of velocity, temperature, and concentration and their gradients were obtained from these solutions. The experimental verification of these results was carried out in a special air-water facility. Concentration of water vapor in air was obtained through the use of a Mach-Zehnder interferometer and the thermocouple-measured temperatures. Analytical and experimental results are in good agreement and indicate a marked influence of the interfacial motion on heat and mass transfer rates. In co-current flow the increase in the interfacial velocity increased the heat and mass removal resulting from the finite velocity of the interface itself and the increased velocities in the boundary layer close to the interface. Author (GRA)

N72-27661# National Science Foundation, Washington, D.C.
NATIONAL HAIL RESEARCH DEVELOPMENT Final Environmental Impact Statement
15 Mar. 1972 24 p
(PB-207539-F; ELR-3052) Avail: NTIS CSCL 13B

The statement concerns experiments in which silver iodide will be delivered by various means into randomly selected developing hail cells to develop and test techniques for modifying hailstorms. The test area is centered on the Pawnee National Grasslands in northeastern Colorado and comprises parts of Logan, Morgan, and Weld Counties, Colo.; Cheyenne and Kimball Counties, Nebr.; and Laramie County, Wyo. The temporary alteration of precipitation patterns in the sparsely settled test area will have a minimal impact. The level of silver resulting from the silver iodide is not expected to be higher than for other seeding operations. Hazards from rockets and rocket parts are minimal. Author (GRA)

N72-27662# Israel Program for Scientific Translations, Ltd., Jerusalem.
DETERMINATION OF THE WATER EQUIVALENT OF SNOW COVER: METHODS AND EQUIPMENT
L. K. Vershinina, ed. and A. M. Dimaksyan, ed. 1971 147 p refs Transl. into ENGLISH of the publ. "Issledovaniya metodov, aparatury i tochnosti opredeleniya zapasov vody v snezhnom pokrove" Leningrad, Gidrometeorol., 1969 180 p Sponsored by NOAA and NSF
(TT-70-50093) Avail: NTIS HC $3.00 CSCL 04B

Methodical and experimental errors of airborne Gamma Surveys are estimated from experimental and theoretical data. Consideration is given to the effect of soil moisture content, snow surface relief and locality off-course aircraft deviations, and hydrographic elements. Data also cover assessment of long term variability in water reserves of the upper soil layer during the autumn-water period, statistical estimates of areas with homogeneous snow cover depth distributions, and principle rules in selecting and charting courses for airborne measurement of snow water equivalent. GRA

N72-27663# Israel Program for Scientific Translations, Ltd., Jerusalem.
ACTINOMETRY AND ATMOSPHERIC OPTICS
V. K. Pyldmaa, ed 1971 391 p refs Transl. into ENGLISH of the publ. "Aktinometriya i atmosfernaya optika" Talin, Valgus, 1968 p 1-387 Proc. of 6th Interdept. Symp. on Actinometry and Atmospheric Optics, Tartu, Jun. 1966 Sponsored by ESSA and NSF
(TT-70-50159) Avail: NTIS CSCL 04A

Contents: radiation regime of the atmosphere; radiation and

weather; actinometric instruments; and radiation and plants.
GRA

N72-27664# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
NEUTRAL COMPOSITION MEASUREMENTS OF THE MESOSPHERE AND LOWER THERMOSPHERE
Charles R. Philbrick, Gerard A. Faucher, and Raymond A. Wlodyka 6 Dec. 1971 19 p
(AF Proj. 6687)
(AD-739169; AFCRL-71-0602; AFCRL-ERP-376) Avail: NTIS CSCL 04/2

A recently developed rocket-borne mass spectrometer which employs a LN2 cryosorption pump has successfully obtained the first direct measurements of the major and minor neutral constituents of the mesosphere and lower thermosphere. The mass analysis is performed using an rf quadrupole spectrometer with an electron impact ion source. Measurements were obtained from two flights, and the preliminary results from one of these are presented. The constituents measured include N2, O2, Ar, O, CO2, O3, and several other minor constituents. Measurements were obtained from 70 to 120 km. Atomic oxygen measurements were obtained between 85 km and apogee on both up-leg and down-leg of the flight. The atomic oxygen measurements were obtained at lower altitudes by switching the ion source potentials on alternate spectral scans to ionize with 20-eV electrons. The lower ionizing energy reduces that portion of the signal at 16 amu due to dissociative ionization of O2. Number density profiles of individual constituents were obtained by normalizing the relative abundances to a density model. Author (GRA)

N72-27665# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METEOROLOGICAL SATELLITES AND THE WEATHER SERVICES
V. A. Bugaev 17 Dec. 1971 19 p Transl. into ENGLISH from Zenlya i Vselennaya (USSR), no. 1, 1970 p 21-28
(AD-739291; FTD-HT-23-1212-71) Avail: NTIS CSCL 04/2

A brief survey is given of the current capabilities of meteorological satellites in terms of coverage and quality of measurement, with emphasis of the use of this data for weather forecasting. Real-time television coverage of cloud formation is described, and illustrations are given of specific cloud structures including interpretation of the attendant weather situation. Measurements of solar radiation and of the earth's albedo are also discussed. Author (GRA)

N72-27666# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
WEATHER RADAR INVESTIGATIONS ON AN ARTILLERY TEST CONDUCTED IN THE PANAMA CANAL ZONE
Michael D. Hudlow Jul. 1971 35 p refs
(DA Proj. 1To-62111-A-026)
(AD-739485; ECOM-5411) Avail: NTIS CSCL 19/1

The Atmospheric Sciences Laboratory (ASL), Fort Monmouth, New Jersey, participated in an artillery fuzing test near Fort Sherman, Panama Canal Zone, during October and November 1968. A radar team and an AN/MPS-34 radar from ASL provided 24-hour radar surveillance of all cloud areas in the vicinity of the firing range. A description of the test and a discussion of radar climatology as deduced from the experiment are presented. Storm characteristics such as size, height, origin, direction, and speed of movement, etc., are illustrated. The potential usefulness of weather radar for detection of precipitation areas posing problems for certain artillery applications is discussed. Author (GRA)

N72-27667# Environmental Prediction Research Facility (Navy), Monterey, Calif.
A SUMMARY OF THE US NAVY PROGRAM AND FY 1971 PROGRESS IN WEATHER MODIFICATION AND CONTROL
Jan. 1972 84 p refs Presented at the Interagency Conf. on Weather Modification, Skyland, Va., 12-15 Oct. 1971
(AD-739364; ENVPREDRSCHFAC-Tech-Paper-1-72) Avail: NTIS CSCL 04/2

Contents: Scope of Navy Research and Development in Weather Modification; Cloud Physics at Naval Research Laboratory; Computer Studies in Support of the Navy Weather Modification Program; Weather Modification Research and Development at the Naval Weapons Center; Weather modification Research Programs at the Office of Naval Research.
Author (GRA)

N72-27668# Oklahoma State Univ., Stillwater. School of Electrical Engineering.
A CENTER FOR THE DESCRIPTION OF ENVIRONMENTAL CONDITIONS. WEATHER PHENOMENA Annual Progress Report, 1 Oct. 1970 - 1 Oct. 1971
William L. Hughes, Paul A. McCollum, and Emmett J. Pybus Dec. 1971 98 p refs
(Contract DAAB07-68-C-0083; DA Proj. 1T0-61102-B-81-A; Proj. Themis)
(AD-739544; OSU-WP-71-I-13; ECOM-0083-13; APR-4) Avail: NTIS CSCL 04/1

The Oklahoma State University Themis Weather Phenomena Project sampled severe storm sferics in the vicinity of central Oklahoma and the Black Hills of South Dakota, as well as warm cumulus electrostatic fields in the Brownsville, Texas area. Data analysis has shown continued association of increased sferics with increasing severity of a storm. However, discrete storm events such as a tornado or hail do not consistently correlate with enhanced sferics in the VLF. Storm impulse periods are apparent from a sferic-rate power density spectral analysis performed on both airborne and ground based data. A cumulus, charge-density structure, model has been devised and a field-mill data reduction model is not being developed. Author (GRA)

N72-27669# Systems Science and Software, La Jolla, Calif.
THE EFFECTS OF MESO-SCALE AND SMALL-SCALE INTERACTIONS ON GLOBAL CLIMATE Semiannual Technical Report, 1 Sep. 1971 - 1 Mar. 1972
31 Mar. 1972 220 p refs
(Contract DAHC04-71-C-0018; ARPA Order 1752)
(AD-739541; Rept-3SR-1034; AROD-9951-1) Avail: NTIS CSCL 04/2

The results reported are part of a continuing study to improve numerical models for meso-scale and small-scale effects which influence global weather and its modification. The two major areas being studied are the effects of mountain ranges on energy and momentum transfer and the transient interaction of solar radiation with the earth's atmosphere. A new theoretical and numerical scheme for solving the radiative transfer equation in the earth's atmosphere has been developed. Some improvements in the treatment of Mie scattering are presented, and the overall status of the radiation code is reviewed.
Author (GRA)

N72-27670# Carnegie-Mellon Univ., Pittsburgh, Pa. Inst. of Physical Planning.
OPTIMAL CONTROL STRATEGIES FOR AIR QUALITY STANDARDS AND REGULATORY POLICY
K. O. Kortanek, S. A. Gustafson (Royal Inst. of Technol.), and W. Gorr Aug. 1971 27 p refs Presented at German Operations Res. Soc. 10th Ann Meeting, Bochum
(PB-207976; RR-18) Avail: NTIS HC $3.00 CSCL 13B

The setting of air quality standards for classes of air pollution in a region is one approach to protect public health and welfare by defining limits on levels of pollution in the air. Methods are presented to determine regional emission regulations that are feasible in the sense that they lead to compliance with air quality standards and optimal in the sense that the total economic impact due to implementation is minimized. Author (GRA)

N72-27671# Carnegie-Mellon Univ., Pittsburgh, Pa. Inst. of Physical Planning.
ON THE NUMERICAL DETERMINATION OF OPTIMAL CONTROL STRATEGIES FOR AIR QUALITY STANDARDS AND REGULATORY POLICY
K. O. Kortanek and S. A. Gustafson (Royal Inst. of Tech.) Aug. 1971 27 p refs Presented at Ger. Operations Res. Soc. 10th Ann. Meeting, Bochum Prepared in cooperation with Royal Inst. of Tech., Stockholm
(PB-207975; RR-22) Avail: NTIS HC $3.00 CSCL 13B

A mathematical model is presented which can be used when optimal control strategies are wanted for air pollution abatement, where the minimization of economic impact of implementation is the goal. The requirement that the concentration of pollutants at every point of a given region must be below prescribed levels entails that an infinite number of constraints must be met. The authors describe how to determine computationally an optimal control strategy in an efficient manner. The authors also indicate how to assess the accuracy of a computed solution. Author (GRA)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N72-27672 National Lending Library for Science and Technology, Boston Spa (England).
ON THE DETERMINATION OF ROUTES WITH MINIMUM FLIGHT TIME AT SST FLIGHT ALTITUDES
J. Bessemoulin [1972] 12 p Transl. into ENGLISH from "French/American Meteorological Societies' Joint Meeting" Paris, 1971 p 1-9
(NLL-M-22436-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A method for determining the optimal routes for supersonic transport aircraft is discussed. It was determined that the wind has a reduced effect on aircraft travelling at supersonic speed. The primary consideration is the effect of atmospheric temperature. Atmospheric temperature limits the speed at which the aircraft can operate due to the effect on power output from the engines and aerodynamic heating of the aircraft skin. An analysis of the temperature field at supersonic transport aircraft altitudes is required to attain savings in time of flight and fuel consumption. P.N.F.

N72-27673*# Tennessee Univ., Knoxville. Dept. of Electrical Engineering.
A STUDY OF STRAPDOWN PLATFORM TECHNOLOGY
James C. Hung 15 Apr. 1972 202 p refs
(Contract NAS8-27296)
(NASA-CR-123710; S-23) Avail: NTIS HC $12.25 CSCL 17G

The proceedings of a conference on the technology of strapdown inertial guidance systems are presented. Subjects discussed are: (1) principles of strapdown inertial guidance, (2) rebalance loop analysis, (3) strapdown platforms using redundant two-degree-of-freedom gyros, (4) attitude algorithms applied to inertial systems, (5) rebalance electronics, and (6) analysis of several strapdown systems. Mathematical models and graphs are included to support the theoretical considerations. For individual titles, see N72-27674 through N72-27678.

N72-27674* Tennessee Univ., Knoxville.
INTRODUCTION
J. C. Hung *In its* A Study of Strapdown Platform Technol. 15 Apr. 1972 p 1-7 refs (For availability see N72-27673 18-21)
CSCL 17G

An analysis of the principles of strapdown inertial platforms is presented, and the advantages of the strapdown system as compared to other stabilized systems are discussed. The application of the rebalance loop to continuously restore the position of sensor output axes is described. The attitude logarithms and the rebalance electronics which are required for accurate navigation are examined. Author

N72-27675* Tennessee Univ., Knoxville.
REBALANCE LOOP ANALYSIS
J. C. Hung and W. L. Rowe *In its* A Study of Strapdown Platform Technol. 15 Apr. 1972 p 8-36 (For availability see N72-27673 18-21)
CSCL 17G

The analysis of the pulse rebalance loop where the pulses are of constant amplitude type is presented. Properties of such systems are discussed. Sensor errors caused by the distortion of the pulse shape, the dc bias, and the sampling process are analyzed. Author

N72-27676* Tennessee Univ., Knoxville.
STRAPDOWN PLATFORMS USING REDUNDANT TWO-DEGREE-OF-FREEDOM GYROS
J. C. Hung and LeSi Han *In its* A Study of Strapdown Platform Technol. 15 Apr. 1972 p 37-69 (For availability see N72-27673 18-21)
CSCL 17G

A new concept of high reliability strapdown attitude sensing systems for space vehicles is presented. Each system utilizes a set of redundant two-degree-of-freedom gyros. An optimum system configuration is obtained for maximum system reliability and the best measurement accuracy. Improved accuracy of the final data is obtained by using the least-square data reduction technique. Each system possesses a sensor performance management feature which is capable of failure detection, faulty gyro identification, system reconfiguration, and possibly, sensor recalibration. Improvement in reliability as compared to other types of strapdown systems is demonstrated. Details of the development are described in terms of a system containing four gyros. Author

N72-27677* Tennessee Univ., Knoxville.
DAA REALIZATIONS OF ATTITUDE ALGORITHMS
J. C. Hung and Y. Yeh *In its* A Study of Strapdown Platform Technol. 15 Apr. 1972 p 70-133 refs (For availability see N72-27673 18-21)
CSCL 17G

The attitude algorithms applied to strapdown inertial platforms are discussed. A review of six attitude transformation algorithms and the realizations of these algorithms by digital differential analyzers are presented. The number of digital differential analyzers for each algorithm is either smaller than or equal to that obtained by others. Author

N72-27678* Tennessee Univ., Knoxville.
REBALANCE ELECTRONICS
T. V. Blalock and E. J. Kennedy *In its* A Study of Strapdown Platform Technol. 15 Apr. 1972 p 134-185 refs (For availability see N72-27673 18-21)
CSCL 17G

Two basic types of strapdown gyroscope rebalance-electronics were analyzed and compared. These two types were a discrete-pulse ternary system and a width-modulated binary system. In the analyses, major emphasis was placed on the logic sections, the H-switches, the precision voltage reference loops, the noise performance, common-mode rejection, and loop compensation. Results of the analyses were used in identifying specific advantages and disadvantages of system details and in making accuracy and resolution comparisons. Sound engineering principles were applied in the development of both systems; however, it was concluded that each system has some disadvantages that are amenable to improvement. Author

N72-27679*# Stanford Univ., Calif. Center for Systems Research.
GUIDANCE AND CONTROL OF FLIGHT VEHICLES Annual Progress Report
J. V. Breakwell, A. E. Bryson, Jr., and G. F. Franklin Dec. 1971 18 p refs
(Grant NGL-05-020-007)
(NASA-CR-127268) Avail: NTIS HC $3.00 CSCL 17G

Progress reports on guidance and attitude control mechanisms of different flight vehicles are presented. The vehicles considered include orbiting spacecraft, supersonic aircraft, and general aviation aircraft. Data also cover orbital transfer using low thrust, automatic landing logic for aircraft, optimal and three dimensional turns for supersonic aircraft, and orbital rendezvous. E.H.W.

N72-27680*# Teledyne Brown Engineering, Huntsville, Ala.
SKYLAB EXPERIMENTAL PERFORMANCE EVALUATION MANUAL. APPENDIX O: EXPERIMENT T002 MANUAL NAVIGATION SIGHTINGS (MSFC)
K. S. Purushotham May 1972 59 p refs
(Contract NAS8-21804)
(NASA-CR-61386-APP-O) Avail: NTIS HC $5.00 CSCL 17G

A series of analyses for Experiment T002, Navigation Sightings (MSFC), to be used for evaluating the performance of the Skylab corollary experiments under preflight, inflight, and post-flight conditions are presented. Experiment contingency plan workaround procedure and malfunction analyses are presented in order to assist in making the experiment operationally successful. Author

N72-27681# Advisory Group for Aerospace Research and Development, Paris (France).
GUIDANCE AND CONTROL OF TACTICAL MISSILES
May 1972 118 p refs
(AGARD-LS-52) Avail: NTIS HC $8.00

The control and guidance of tactical missiles with emphasis on cost, reliability, and performance are discussed. The utility of modern analysis and evaluation tools and techniques associated with the several commonly used control and guidance concepts are also examined. For individual titles, see N72-27682 through N72-27693.

N72-27682 Martin Marietta Corp., Orlando, Fla.
GENERAL CONSIDERATIONS IN GUIDANCE AND CONTROL TECHNOLOGY
Philip C. Gregory *In* AGARD Guidance and Control of Tactical Missiles May 1972 14 p (For availability see N72-27681 18-21)

A particular set of mission requirements for an air-to-air missile and an automated design process to synthesize these requirements into the preliminary design of a missile and guidance system are described. This process makes use of the CAMS (Computer Aided Missile Synthesis) digital computer program which was developed to: (1) synthesize missile configurations including the guidance, controls, secondary power, warhead, and propulsion subsystems; (2) furnish resulting flight performance including trajectories and miss distance; and (3) estimate unit costs. Author

N72-27683 Boeing Co., Seattle, Wash. Aerospace Group.
DEVELOPMENT OF CONTROL SYSTEM REQUIREMENTS
Robert Goodstein *In* AGARD Guidance and Control of Tactical Missiles May 1972 7 p (For availability see N72-27681 18-21)

The development of control system requirements for tactical missiles is discussed. The timing of control system requirements and the manner in which requirements are incorporated are described. Three examples are presented to show the variety of issues, candidate solutions, and selections of control systems to meet requirements. The type of weapon system requirement, process of analysis, and reasoning on concept selection are included to show application to advanced missile design. Author

N72-27684 McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
ADJOINT SOLUTIONS TO INTERCEPT GUIDANCE
D. L. Pitman *In* AGARD Guidance and Control of Tactical Missiles May 1972 5 p (For availability see N72-27681 18-21)

The adjoint equations yielding the error sensitivities of a linear system are explained. The Laplace transforms representing the solutions of the adjoint equations of a linear interceptor guidance system are developed. The solutions for an interceptor, represented by a first-order lag and utilizing proportional navigation, are derived. Author

N72-27685 McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
OPTIMIZATION
D. L. Pitman *In* AGARD Guidance and Control of Tactical Missiles May 1972 4 p (For availability see N72-27681 18-21)

The procedure for optimizing a linear system against a quadratic cost function is developed by the method of completing a square. The optimal intercept guidance law against a nonmaneuvering target when the cost is energy lost to drag is shown to be proportional navigation with a gain of 3. Author

N72-27686 McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
KALMAN FILTER
D. L. Pitman *In* AGARD Guidance and Control of Tactical Missiles May 1972 6 p (For availability see N72-27681 18-21)

The Kalman filter is developed as a rational application of Gauss' method of least-mean-square error summing, which adds together independent measurements and estimates proportionally to the inverse of the variances of expected errors. The discrete measurement summer is developed into the continuous filter by shortening the time between measurements. Author

N72-27687 Royal Aircraft Establishment, Farnborough (England).
NUMERICAL ANALYSIS AND SIMULATION EVOLUTION
E. Heap *In* AGARD Guidance and Control of Tactical Missiles May 1972 7 p (For availability see N72-27681 18-21)

A review is given of the quantitative advantages and disadvantages of digital and analogue computer techniques for the simulation of missile guidance and control, and a methodology of using hybrid simulation is developed. It is shown how a hybrid computer can be used to aid the choice of an acceptable missile system within a wide spectrum of complexity, particularly when many non-linear factors and statistical aspects are involved. Using this facility, mathematical modelling not only helps specific projects in their R & D phases, but it can contribute to management decisions in feasibility studies, in the choice of missile instrument combinations, and in the specification of their desired standard of performance. It can also safeguard against complex systems being over-designed to the detriment of their cost. Author

N72-27688 Martin Marietta Corp., Orlando, Fla.
LABORATORY TECHNIQUES AND EVALUATION METHODOLOGY
Philip C. Gregory *In* AGARD Guidance and Control of Tactical Missiles May 1972 10 p (For availability see N72-27681 18-21)

The characteristics of typical electro-optical terminal guidance subsystems including area correlator and gated trackers are furnished to define those parameters (aim and lock-on capability, tracking accuracy, tracking bandwidth, aspect angle capability, sensitivity to target and light level variations, acquisition envelope, and range closure effects) which are important to the system user. A laboratory designed to repeatedly measure these properties is described. Typical area correlator tracker characteristics are furnished and a run schedule defined to evaluate the performance

parameters described. An economic analysis is presented to illustrate the potential cost savings over flight test. Author

N72-27689 Boeing Co., Seattle, Wash. Aerospace Group.
GUIDANCE LAW APPLICABILITY FOR MISSILE CLOSING
Robert Goodstein *In* AGARD Guidance and Control of Tactical Missiles May 1972 6 p (For availability see N72-27681 18-21)

Guidance law general types to produce missile steering signals from sensed target information leading to suitably close miss distances are discussed. Miss distance variations for the different guidance laws are displayed for an air target intercept as target and missile characteristics are changed. A general comparison of guidance law applicability is presented for air and surface targets. Author

N72-27690 Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
SELF-CONTAINED GUIDANCE TECHNOLOGY
R. W. Acus, Jr. *In* AGARD Guidance and Control of Tactical Missiles May 1972 18 p refs (For availability see N72-27681 18-21)

Inertial technology for a self-contained guidance capability applicable to tactical air-to-ground missiles is discussed. The basic inertial system, which consists of accelerometers, gyros and a computer, is immune to outside interference, and therefore ideally suited to military applications in a hostile environment. Inertial technology has progressed to a point where equipment size and cost are within reason for use with the tactical missile. The basic principles and limitations of inertial guidance, including theory of operation, and physical and analytic coordinate system stabilization are presented. Sources of error, and the propagation of these errors are described. Various methods of alignment, and system mechanization are considered. The state of the art, and the research and development process for inertial systems is discussed. Factors influencing the research and development process are identified along with the relationship between inertial system reliability and cost. Author

N72-27691 Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
APPLICATION OF INERTIAL TECHNOLOGY TO A-G MISSILES
R. W. Acus, Jr. *In* AGARD Guidance and Control of Tactical Missiles May 1972 11 p refs (For availability see N72-27681 18-21)

Inertial technology for airborne, stand-off tactical weapon systems, both as a midcourse guidance system, and when used in conjunction with a terminal guidance sensor is discussed. The capabilities of pure inertial guidance are examined as the midcourse guidance system for a stand-off missile. The relationships between enemy defenses, aircraft capability and missile performance are used to define a hypothetical mission, and a set of guidance system requirements. Error magnitudes are selected, and missile positional error is determined as a function of range. The stand-off range of this particular weapon system is limited by the performance of the midcourse guidance system. Various methods of improving midcourse guidance performance are explored. The advantages and limitations of an aided inertial system are reviewed with emphasis on retaining the advantages of the self-contained system. Author

N72-27692 Royal Aircraft Establishment, Farnborough (England).
METHODOLOGY OF RESEARCH INTO COMMAND-LINE-OF-SIGHT AND HOMING GUIDANCE
E. Heap *In* AGARD Guidance and Control of Tactical Missiles May 1972 9 p (For availability see N72-27681 18-21)

Research of command-to-line-of-sight (CLOS) guidance and semi-active homing missile systems is presented. It discusses the kinematics of various guidance laws from CLOS to pursuit courses and proportional navigation from a fundamental point of view. The interaction between the guidance requirements and the missile system is covered and it is shown that the autopilot and sensor effects need to be considered in hybrid computer simulations. The implications on computer requirements for optimum filtering are also discussed. Author

N72-27693 Raytheon Co., Bedford, Mass. Missile Systems Div.
PULSE DOPPLER MISSILE GUIDANCE: REPRESENTATIVE PARAMETERS AND ASSOCIATED FIRE CONTROL CONSIDERATIONS
Henry Zuerndorfer, Howard Lynn, and Gordon Kettering *In* AGARD Guidance and Control of Tactical Missiles May 1972 17 p ref (For availability see N72-27681 18-21)

The principal problems and solution options available for all-weather attack of small tactical targets are discussed. The requirement for all-weather operation against relatively small and possibly mobile targets dictates the use of microwave guidance sensors. The problems of detection and the tracking and fire control considerations associated with the attack of three generic types of tactical targets are presented. The characteristics of the available sensors are described and the applciations for various situations are examined. Author

N72-27694# National Aviation Facilities Experimental Center, Atlantic City, N.J.
TEST AND EVALUATION OF CATEGORY 3 ILS GROUND GUIDANCE EQUIPMENT "STAN-37 LOCALIZER TESTS AT NAFEC ON R/W-4" Interim Report, Feb. 1969 - May 1970
Henry W. Kasper May 1972 122 p
(FAA Proj. 320-111-01X)
(FAA-RD-72-50; FAA-NA-72-14) Avail: NTIS HC $8.25

A STAN-37 localizer (85-foot aperture) was installed and subjected to various tests. These included conformance to ICAO Annex 10 Category 3 ILS specifications, system performance, system and monitor stability and monitor operation under degraded system performance. It was concluded that the system characteristics met ICAO specifications, and that monitor executive action occurs as required when faults are present. System availability sufficient for Category 3 operation should be established during an evaluation under operational conditional conditions. Author

N72-27695# Joint Publications Research Service, Arlington, Va.
IMPROVING ACCURACY OF GYROINSTRUMENTAL CONTROL SYSTEMS
29 Jun. 1972 26 p refs Transl. into ENGLISH from Izv. VUZ, Priborostr. (Leningrad), no. 4, 1972
(JPRS-56387) Avail: NTIS HC $3.50

Error analysis and accuracy are considered for gyroscopic instruments used in inertial navigation control systems. For individual titles, see N72-27696 through N72-27699.

N72-27696 Joint Publications Research Service, Arlington, Va.
ERROR OF AN INERTIAL NAVIGATION SYSTEM DESIGNED ON THE BASIS OF AN AZIMUTH GYROCOMPASS
V. A. Karakashev and S. Ya. Rozhetskiy *In its* Improving accuracy of Gyroinstrumental Control Systems 29 Jun. 1972 p 1-7 refs (For availability see N72-27695 18-21)

The errors in an inertial navigation system constructed on the basis of an azimuth gyrocompass and a directional gyro were studied in the course of development of navigational information on the heading, coordinates, and speed of a moving object. Analytic relationships were derived for the errors of the system under review, as a function of instrumental errors in the directional gyro and the aximuth gyrocompass. Author

N72-27697 Joint Publications Research Service, Arlington, Va.
FEASIBILITY OF NEGLECTING THE SMALL TIME CONSTANTS OF THE CONTROL SYSTEMS OF A

SINGLE-AXIS GYROSTABILIZER
N. Ya. Kogan *In its* Improving Accuracy of Gyroinstrumental Control Systems 29 Jun. 1972 p 8-12 refs (For availability see N72-27695 18-21)

The question of small time constants of a control system on the dynamics of a uniaxial gyrostabilizer was investigated.
Author

N72-27698 Joint Publications Research Service, Arlington, Va.
DETERMINING THE DIRECTION OF THE MERIDIAN BY MEANS OF AN ANGULAR RATE SENSOR
V. A. Ivanov *In its* Improving Accuracy of Gyroinstrumental Control Systems 29 Jun. 1972 p 13-17 refs (For availability see N72-27695 18-21)

A system is considered for finding the meridian for a base which is stationary relative to Earth. As a sensor, use is made of an angular acceleration pickup (angular accelerometer). It is shown that the effect of imperfections in the system's components on the accuracy of establishing the meridian was reduced significantly.
Author

N72-27699 Joint Publications Research Service, Arlington, Va.
EXPERIMENTAL STUDY OF THE DISPERSION OF THE MAGNETIC FIELD OF A GYROMOTOR
A. N. Gavrilov, V. Yu. Chizhikov, and Ye. A. Izmaylov *In its* Improving Accuracy of Gyroinstrumental Control Systems 29 Jun. 1972 p 18-25 refs (For availability see N72-27695 18-21)

Requirements imposed on the fluid-floated gyroinstruments take into account the negative effect of the gyromotor's dispersion field on these instruments. Experimental study of the spatial distribution of a field permitted the simplification of the evaluation of this effect.
Author

N72-27700# National Aviation Facilities Experimental Center, Atlantic City, N.J.
INTENSITY CONTROL OF FLASHERS Final Report, Apr. 1970 - Mar. 1972
Bernard Weinstein Jun. 1972 55 p
(FAA-RD-72-54; FAA-NA-72-36) Avail: NTIS HC $4.75

Intensity control of condenser discharge lights with a three-step intensity control was tested. The flashers were used in a runway alignment indicator light system as part of a medium intensity approach light system with sequenced flashers (MALSR) during both day and night and over a wide range of visibility conditions. A voltage sensing circuit, intended to operate the intensity controlled MALSR from the control tower using current changes in the runway lighting circuit, was also tested. One intensity controlled MALSR system 2400 ft long and another 3000 ft long were flight tested. The results indicate the following: (1) The voltage sensing circuit provided satisfactory operation of the MALSR from the control tower. (2) The intensity controlled MALSR operated satisfactorily and adequately supported flight operations. (3) Compatible intensity levels between the MALSR and the runway lights were obtained to provide a satisfactory intensity balance. (4) The operations of condenser discharge lights during night VFR and IFR conditions were not distracting and did not subject pilots to annoying glare.
Author

N72-27701*# Magnavox Co., Silver Spring, Md. Advanced Systems Analysis Office.
MULTIPATH/RFI/MODULATION STUDY FOR DRSS-RFI PROBLEM: VOICE CODING AND INTELLIGIBILITY TESTING FOR A SATELLITE-BASED AIR TRAFFIC CONTROL SYSTEM Final Report, May 1970 - Apr. 1971
J. N. Birch and Norman Getzin Apr. 1971 576 p refs
(Contract NAS5-20168)
(NASA-CR-122432; ASAO-PR20020-2) Avail: NTIS HC $31.00 CSCL 17G

Analog and digital voice coding techniques for application to an L-band satellite-basedair traffic control (ATC) system for over ocean deployment are examined. In addition to performance, the techniques are compared on the basis of cost, size, weight, power consumption, availability, reliability, and multiplexing features. Candidate systems are chosen on the bases of minimum required RF bandwidth and received carrier-to-noise density ratios. A detailed survey of automated and nonautomated intelligibility testing methods and devices is presented and comparisons given. Subjective evaluation of speech system by preference tests is considered. Conclusion and recommendations are developed regarding the selection of the voice system. Likewise, conclusions and recommendations are developed for the appropriate use of intelligibility tests, speech quality measurements, and preference tests with the framework of the proposed ATC system.
Author

N72-27702# National Aviation Facilities Experimental Center, Atlantic City, N.J.
SIMULATION STUDY OF DIAMOND RUNWAY MARKS FOR AIRCRAFT APPROACH GUIDANCE Interim Report, Oct. 1970 - Mar. 1972
Thomas E. Zurinskas Jun. 1972 16 p refs
(FAA Proj. 072-324-12X)
(FAA-NA-72-57) Avail: NTIS HC $3.00

A simulation study was made to determine a pilot's ability to establish a specific glide path angle by perceiving the apparent squareness of an oblong diamond mark on a runway. Twenty subjects were asked to say when they perceived squareness of the diamond marks. The subject's task was to adjust a movable simulated runway, which sloped upward or downward from level, changing the perspective of the marks until the first diamond mark in the runway centerline appeared to be square. The median viewing angle of each subject's judgements was his score. Two diamond centerlines of different dimensions were simulated: (1) one with diamonds 10 feet wide by 75 feet long, and (2) another with diamonds 10 feet wide by 150 feet long. The range of the scores was approximately 3 deg for the 10/75 diamonds, and approximately 6 deg for the 10/150 diamonds. In general, the results of this study do not support the hypothesis that the perception of squareness of a diamond runway marking is a sufficiently accurate technique for establishing a suitable glide path angle.
Author

N72-27703*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPARATUS FOR AIDING A PILOT IN AVOIDING A MIDAIR COLLISION BETWEEN AIRCRAFT Patent Application
James H. Schrader and Richard H. Couch, inventors (to NASA)
Filed 7 Apr. 1972 29 p
(NASA-Case-LAR-10717-1; US-Patent-Appl-SN-242028) Avail: NTIS HC $3.50 CSCL 17G

A system for aiding a pilot in avoiding a midair collision between aircraft is described. The system consists of a protected aircraft equipped with a transmitter, transponder, receiver, and data processor. The intruding aircraft is similarly equipped. The signal from the most hazardous intruding aircraft is received by the protected aircraft and applied to the data processor. The data processor determines the closing velocity of the aircraft, the range between aircraft, altitude difference, and time to possible collision. The timeliness of the warning information makes it possible to avoid midair collisions.
NASA

N72-27704# Joint Publications Research Service, Arlington, Va.
NAVIGATIONAL CYBERNETICS OF FLIGHT
M. A. Kirst 13 Jul. 1972 181 p refs Transl. into ENGLISH of the book "Navigatsionnaya Kibernetika Poleta" Moscow, Banter Publishing House. 1971 182 p
(JPRS-56487) Avail: NTIS HC $11.25

Methods and principles for constructing navigational systems and improving navigational procedures are presented. Various systems such as inertial-Doppler, astro-inertial, astro-inertial-Doppler, and radio-inertial are discussed. The properties of the systems are described and their specific applications are explained.

Diagrams of the components of the various systems are included. Mathematical models are developed to support the theoretical considerations. P.N.F.

N72-27705# Joint Publications Research Service, Arlington, Va.
THE "EYES" OF AN AIRPORT
V. Kulikov 11 Jul. 1972 5 p Transl. into ENGLISH from Radio (Moscow), no. 5, 1972 p 15-16
(JPRS-56463) Avail: NTIS HC $3.00

A description of an air traffic control radar system in use in U.S.S.R. is presented. The specifications of the radar are identified and its performance parameters are discussed. The radar has 53 percent solid state and only 1.6 percent vacuum tube components in its circuitry. The radar also is equipped with an interrogator, which by means of a responder in the aircraft, transmits data concerning the altitude of the aircraft, aircraft identification, and fuel remaining in aircraft tanks. Author

N72-27706*# Genoa Univ. (Italy).
TWO EXAMPLES OF APPLICATIONS OF KALMAN FILTERING TO INTEGRATED SYSTEMS OF NAVIGATION [DUE ESEMPI DI APPLICAZIONI DEL FILTRO DI KALMAN AD EQUIPAGGIAMENTI INTEGRATI DI NAVIGAZIONE]
Aldino Ferraro and Aleramo L. Lucifredi Dec. 1970 18 p refs In ITALIAN Submitted for publication Sponsored jointly by ESRO and NASA
(NASA-CR-127253; IIR-70-LF-157) Avail: NTIS HC $3.00 CSCL 17G

Two applications of optimal stochastic filters to navigation systems are described. The first is an air navigation system consisting of an inertial device (INS) and a Loran, plus an altimeter. The second is an application to a system of submarine navigation consisting of an inertial device (SINS) and an Omega plus a depth sensor. ESRO

N72-27707# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Raumfahrt.
ESRO-ATC BALLOON-AIRCRAFT SATELLITE SIMULATION EXPERIMENT 1971. VOL. 2: MULTIPATH ANALYSIS (MATHEMATICAL) FROM ANALOGUE MAGNETIC RECORDINGS GENERATED IN EXPERIMENTED FLIGHTS DURING ATC CAMPAIGN, 1971 Final Report
Peter Horn Mar. 1972 131 p refs
(Contract ESTEC-1458-71-CG)
Avail: NTIS HC $8.75

As part of the development of a European aeronautical satellite, a mathematical multipath analysis from analog magnetic recordings generated in experimental flights is presented. The satellite is simulated by a balloon. Experimental multipath phenomena were investigated in the light of theoretical predictions. The study was restricted to pure CW signals, and data processing by fast Fourier transformation was covered in addition. Data are presented in graphical form. ESRO

N72-27708# Technische Univ., Berlin (West Germany). Inst. fuer Flugfuehrung und Luftverkehr.
THE QUASI-VISUAL FLIGHT: A NEW NAVIGATION CONCEPT [DER QUASI-SICHTFLUG: EIN NEUES KONZEPT DER FLUGFUEHRUNG]
Joachim Wernicke Sep. 1971 37 p refs In GERMAN
(Rept-62) Avail: NTIS HC $4.00

An air navigation system is described which uses the concept of interferometric measurements of signals received from microwave radio beacons on the ground and in other aircraft similarly equipped. The position of the aircraft as well as that of aircraft in the vicinity are shown on a display device. The pilot can thus initiate a collision avoidance maneuver. The advantages of such a system over present day air traffic control are stressed, especially freedom from fixed predetermined air routes and much shorter security margins. Costs of such a system are estimated and compared with those of present air traffic control in Germany. ESRO

N72-27709# Airborne Instruments Lab., Deer Park, N.Y.
EVALUATION OF THE 1968 FAA/DOD BEACON FLIGHT TEST IN NEW YORK Final Report
Richard L. Lella Sep. 1970 199 p
(Contract DOT-FA70WA-2267)
(AD-738680; AIL-9206-1; FAA-RD-70-60) Avail: NTIS CSCL 17/7

The study examines beacon test data taken by FAA/DOD during a 4-hour flight over the New York area. The object was to develop methods of processing the data and to extract information characterizing the performance of the beacon system. Parameters used to evaluate performance include scan reliability, probability of a missed report, classification of misses according to cause, code errors, spurious target reports, and range azimuth accuracy estimation. For data available on magnetic tape, computer programs were developed to tabulate beacon malfunctions. Techniques were developed to estimate the probabie cause of a malfunction. Author (GRA)

N72-27710# Little (Arthur D.), Inc., Cambridge, Mass.
ILLUSTRATIVE APPLICATIONS OF AIR TRAFFIC CONTROL SYSTEM CAPACITY STUDY METHODOLOGY Interim Report, Nov. 1970 - Sep. 1971
G. Raisbeck, J. L. Everett, and B. O. Koopman Nov. 1971 46 p refs
(Contract DOT-FA70WA-2141)
(AD-738892; FAA-RD-71-113) Avail: NTIS CSCL 17/7

The long-range objective of this program is to develop tools and techniques to define, measure, and predict the capacity of an air traffic control system, which can then be used in analytical studies in support of long-range plans, management decisions, and system performance evaluations. The method of approach in this contract provides for testing and refining these tools by using them in typical current problems. This report illustrates the application of these tools to five typical current problems: The origins of delays in aviation operations; Insensitivity of queue parameters to server statistics; Operational measurements in the terminal control area; Structuring cost-benefit methodology for ATC capacity improvement measures; and Establishing practical safety goals in air traffic control. GRA

N72-27711# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
FREQUENCY MODEL FOR THE GI-T1-B SINGLE DEGREE OF FREEDOM RATE INTEGRATING GYROSCOPE
Thomas S. Rhoades 3 Dec. 1971 24 p refs
(AF Proj. 7628)
(AD-739182; AFCRL-71-0599; ACRL-IP-172) Avail: NTIS CSCL 17/7

A frequency model for the GI-T1-B single degree of freedom rate integrating gyroscope is derived using an Eulerian formulation. Comparison is made of the GI-T1-B frequency response with a nominal single degree of freedom rate integrating gyro, detailing those features which make the GI-T1-B gyro more desirable as an instrument in the empirical investigations of the effect of seismic disturbances on gyroscopic devices.
Author (GRA)

N72-27712# Aerospace Corp., El Segundo, Calif. Lab. Operations.
EFFECT OF SATELLITE ORBITAL PERTURBATIONS ON THE PROPOSED GYROSCOPE TEST OF GENERAL RELATIVITY Technical Report, Aug. - Sep. 1971
Yam T. Chiu 15 Mar. 1972 14 p refs
(Contract F04701-71-C-0172)
(AD-739500; TR-0172(2260-10)-2; SAMSO-TR-72-62) Avail: NTIS CSCL 20/10

The report discusses the orbital perturbation effects on the responses of the subtly arranged gyroscope system proposed to test general relativity in a polar-orbiting satellite. It is shown that secular orbital plane precession due to oblateness of the earth may impair the ability of the experiment to distinguish the Einstein and Brans-Dicke theories of relativity. Author (GRA)

N72-27713# Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.
ADVANCED CARRIER-BASED AIR TRAFFIC CONTROL Technical Report, 15 Mar. - 14 Dec. 1971
Nelson R. Zagalsky, Keith L. Curtner, and Robert P. Irons Mar. 1972 90 p refs
(Contract N00014-71-C-0265; NR Proj. 215-188)
(AD-739713; F2027-IR1) Avail: NTIS CSCL 17/7

A carrier-based air traffic control system which features enroute trajectory optimization and a computer-aided marshal reassignment procedure is described. The development of the trajectory optimization procedure is followed by a description of a computer simulation to be used as a design tool and for the demonstration of concept feasibility. The simulation model features an F4 mathematical model and an interactive controller's display console. Author (GRA)

N72-27714# Naval Electronics Lab. Center, San Diego, Calif.
OMEGA ARCTIC PROPAGATION: SYNCHRONIZED MONITORING AT WALES, ALASKA 1969/1970 Research and Development Report, May 1969 - Mar. 1971
I. J. Rothmuller, E. R. Swanson, C. P. Kugel, and J. E. Britt 11 May 1971 237 p refs
(AD-739689; NELC-TR-1765) Avail: NTIS CSCL 17/7

Within the program of development of an accurate VLF hyperbolic navigation system for worldwide use by ships and aircraft, NELC conducts propagation studies and develops methods for propagation prediction. The report is an analysis of 10.2- and 13.6-kHz data obtained at Wales, Alaska. It shows that the VLF auroral zone is circularly symmetric about the North Pole, and that the area covered may be sensitive to the planetary K-index. Repeatability is found adequate to allow eventual navigational accuracy of about 1 mile. Author (GRA)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N72-27715 National Lending Library for Science and Technology, Boston Spa (England).
THERMAL MODELS OF NUCLEAR FUEL ELEMENTS
A. Teytu 11 May 1972 18 p Transl. into ENGLISH from Bull. Inform. Sci. Tech. (Paris), no. 156, Feb. 1971 p 13-22
(NLL-CE-Trans-5885-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Various types of electric heaters are described which were used to simulate nuclear fuel elements in heat transfer experiments. The types of heater include plate and bundle types, heaters with dc in the jacket and ones in which the sheath is insulated from the electrical supply. The choice of heater for particular problems is discussed. Author

N72-27716 National Lending Library for Science and Technology, Boston Spa (England).
A SERIES OF EXPERIMENTS TO STUDY THE BEHAVIOUR OF METALLIC INSULATIONS IN HELIUM
H. D. vonderWeyden 7 May 1972 16 p Transl. into ENGLISH from Krupp Reaktorbam GmbH (Manheim)
(NLL-WH-Trans-321-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

An investigation was made of the behavior of metallic nuclear power plant insulations in helium. The tests were conducted under operating conditions of the THTR-300. Data cover the effects of temperature, local and average heat flux densities, and dynamic and static pressure. E.H.W.

N72-27717*# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
EVALUATION OF INSULATION MATERIALS AND COMPOSITES FOR USE IN A NUCLEAR RADIATION ENVIRONMENT, PHASE 1
W. A. Greenhow and J. H. Lewis Washington NASA May 1972 321 p refs
(Contract NAS8-25848)
(NASA-CR-2045; FZK-378) Avail: NTIS HC $6.00 CSCL 18T

This study has been carried out to evaluate flight-qualified Saturn 5 materials, components, and systems for use, with or without modification, in the radiation environment of the nuclear flight system. The results reported herein are primarily intended to aid designers in their evaluation and selection of off-the-shelf equipments which may meet the stringent requirements and specifications associated with application on a reusable nuclear powered space system, i.e., the reusable nuclear shuttle. One of the factors which must be evaluated in the design of the RNS is the effects of radiation on materials; and it is toward this aspect of the overall effort that this analysis has been directed. Author

N72-27718*# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
EVALUATION OF INSULATION MATERIALS AND COMPOSITES FOR USE IN A NUCLEAR RADIATION ENVIRONMENT, PHASE 2 Final Report
D. E. Westerheide, H. G. Carter, R. C. Erickson, and E. E. Kerlin Washington NASA May 1972 206 p refs
(Contract NAS8-25848)
(NASA-CR-2042; FZK-380) Avail: NTIS HC $3.00 CSCL 18J

The nuclear heating of the propellant in all of the four baseline RNS configurations studied was much lower than that of the nuclear flight module configuration with the 5000-MW NERVA analyzed previously. Although the nuclear heating has been reduced, the effect of nuclear heating on the propellant as well as the effect of nuclear heating on internal structures such as antivortex baffles, screens, and sump components cannot be neglected. In addition, it was found that the present analytical procedures were not able to predict boundary layer initiation and breakoff points with the accuracy necessary to predict propellant thermodynamic nonequilibrium (stratification) and/or mixing.
Author

N72-27719*# Scientific Translation Service, Santa Barbara, Calif.
TARGETS FOR NEUTRON GENERATORS
H. Fabian Washington NASA Jul. 1972 24 p Transl. into ENGLISH of "Targets fuer Neutronengeneratoren" Rept. BMVg-FBWT-F1-8, Bundesmin. der Verteigigung, Bonn, Nov. 1970 36 p
(Contract NASw-2035)
(NASA-TT-F-14337; BMVg-FBWT-F1-8) Avail: NTIS HC $3.25 CSCL 18J

The development work on solid and gaseous tritium targets having a high thermal capacity, a long lifetime, and a high specific neutron yield is described. The targets prepared have a thermal resistance up to 450 C, a neutron yield increase of 15%, and a tritium reservoir to prolong target lifetime. Gas targets were also developed. Special devices are mentioned for target holding, moving, transportation, and storage. Author

N72-27721*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A 1055 FT/SEC IMPACT TEST OF A TWO FOOT DIAMETER MODEL NUCLEAR REACTOR CONTAINMENT SYSTEM WITHOUT FRACTURE
Richard L. Puthoff Jun. 1972 25 p refs
(NASA-TM-X-68103; E-6942) Avail: NTIS HC $3.25 CSCL 18I

A study to determine the feasibility of containing the fission products of a mobile reactor in the event of an impact is presented. The model simulated the reactor core, energy absorbing gamma shielding, neutron shielding and the containment vessel. It was impacted against an 18,000 pound reinforced concrete block at 1055 ft/sec. The model was significantly deformed and the concrete block demolished. No leaks were detected nor were any cracks observed in the model after impact. Author

N72-27722*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCES OF THE BETTER METALLIC ELECTRODES IN CESIUM THERMIONIC CONVERTERS
James F. Morris 1972 9 p ref Presented at the Intersoc. Energy Conversion Eng. Conf., San Diego, Calif., 25-29 Sep. 1972
(NASA-TM-X-68091; E-7005) Avail: NTIS HC $3.00 CSCL 18I

Outputs are presented for some cesium diodes having primarily emitters of highly oriented polycrystalline or single-crystal 110 tungsten or .0001 rhenium. Power densities at 10 A/sq cm or 0.5 V appear as functions of emitter temperatures and electrode spacings. Author

N72-27723*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GAS-CORE REACTOR POWER TRANSIENT ANALYSIS
Albert F. Kascak 1972 18 p refs Presented at Am. Nucl. Soc. Meeting, Las Vegas, Nev., 18-22 Jun. 1972
(NASA-TM-X-68089; E-7000) Avail: NTIS HC $3.00 CSCL 18I

The gas core reactor is a proposed device which features high temperatures. It has applications in high specific impulse space missions, and possibly in low thermal pollution MHD power plants. The nuclear fuel is a ball of uranium plasma radiating thermal photons as opposed to gamma rays. This thermal energy is picked up before it reaches the solid cavity liner by an inflowing seeded propellant stream and convected out through a rocket nozzle. A wall-burnout condition will exist if there is not enough flow of propellant to convect the energy back into the cavity. A reactor must therefore operate with a certain amount of excess propellant flow. Due to the thermal inertia of the flowing propellant, the reactor can undergo power transients in excess of the steady-state wall burnout power for short periods of time. The objective of this study was to determine how long the wall burnout power could be exceeded without burning out the cavity liner. The model used in the heat-transfer calculation was one-dimensional, and thermal radiation was assumed to be a diffusion process. Author

N72-27724# Atomic Energy Commission, New York. Health and Safety Lab.
GLOBAL INVENTORY AND DISTRIBUTION OF Pu-238 FROM SNAP-9A
Edward P. Hardy, Jr., Philip W. Krey, and Herbert L. Volchok 1 Mar. 1972 32 p refs
(HASL-250) Avail: NTIS

Following the burn-up of a SNAP generator containing Pu-238 in the upper atmosphere of the Southern Hemisphere in April 1964, balloon and aircraft sampling successfully documented the atmospheric transport and inventory of the debris from this unexpected release. By the end of 1970, results of the stratospheric measurements indicated that 95% of the SNAP plutonium had deposited over the earth's surface. Integrated fallout in the form of soil samples collected at over 60 sites throughout the world provided the data required to assess the distribution pattern and inventory of the deposited SNAP debris. Of the 17 kilocuries of Pu-238 originally in the generator, 13.4 plus or minus 2.2 kilocuries are globally deposited with 3.1 plus or minus 0.8 kilocuries in the Northern Hemisphere and 10.3 plus or minus 2.1 kilocuries in the Southern Hemisphere. This accounts for essentially all of the Pu-238 inadvertently released as a result of the satellite abort. Author (NSA)

N72-27725# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
INFLUENCE OF A LOCAL OBSTRUCTION ON HEAT TRANSFER IN PACKED BEDS
J. J. Ginoux and C. Joly May 1972 31 p Presented at the Thermohydraulics Specialist Meeting, Windscale, Engl., 17-19 May 1972
(VKI-TN-80) Avail: NTIS HC $3.75

The influence of a local obstruction on heat transfer between one fuel particle in a packed bed and the coolant gas was studied. A method was chosen and developed giving average as well as local heat transfer coefficients in the case of a packed bed containing spherical particles of constant diameter. The results show an important decrease in the average cooling of a sphere near the obstruction and important local variations of the heat transfer coefficient over the surface of the sphere. ESRO

N72-27726# Naval Research Lab., Washington, D.C.
IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS Quarterly Progress Report, 1 Nov. 1971 - 31 Jan. 1972
L. E. Stelle, P. Shaninian, H. H. Smith, H. E. Watson, and J. R. Hawthorne 15 Feb. 1972 42 p refs
(AD-739312; NRL-MR-2398) Avail: NTIS CSCL 18/10

The research program of the NRL Metallurgy Division, Reactor Materials Branch, involves a broad study of the effects of nuclear radiation upon materials. This report, covering research for the period 1 November 1971-31 January 1972, includes: (1) a study on fatigue crack growth rates in several 300 series stainless steels, (2) the effect of irradiation on the fatigue properties of thin section Type 348 stainless steel at 550F (288C), (3) an evaluation of notch toughness of AISI Type 304 and 316 stainless steel submerged arc weldments, (4) description of a subsize R-specimen for assessments of postirradiation fracture extension resistance, (5) electron microscopy observations of the postirradiation microstructure of pure iron and dilute iron alloys (6) mechanisms of vacancy generation in laser bombarded targets, and (7) the cyclotron simulation of helium transmutation damage in 304 stainless steel. Author (GRA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N72-27727 Rensselaer Polytechnic Inst., Troy, N.Y.
ACOUSTIC RAY PROPAGATION IN CHANNELS WITH A HORIZONTAL SOUND SPEED GRADIENT Ph.D. Thesis
James Thomas Warfield 1971 207 p

Avail: Univ. Microfilms Order No. 72-1215

The geometric theory of sound rays is used to study the effects of a horizontal gradient in sound speed that is constant in magnitude and direction. Ray geometry, travel time, and spreading loss are studied as rays are traced in a horizontal channel. Those rays that intercept an arbitrarily placed receiving point after experiencing a given number of boundary reflections are determined. The initial angles, travel time and spreading loss of these rays are studied in terms of source-receiving point geometry and the horizontal sound speed gradient, and these quantities are compared with the corresponding values when the horizontal gradient is absent. It is shown that the changes in travel time and spreading loss brought about by the presence of the horizontal gradient are approximately proportional to the component of the gradient in the horizontal direction of the receiving point. Dissert. Abstr.

N72-27728* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

STEREOSCOPIC TELEVISION SYSTEM AND APPARATUS Patent

James L. Jones, inventor (to NASA) Issued 13 Jun. 1972 6 p Filed 20 Oct. 1969 Supersedes N70-20722 (08 - 08, p 1407) (NASA-Case-ARC-10160-1; US-Patent-3,670,097; US-Patent-Appl-SN-867842; US-Patent-Class-178-6.5; US-Patent-Class-178-DIG.20; US-Patent-Class-350-138) Avail: US Patent Office CSCL 20F

A stereoscopic remote viewing system is provided, including a remote camera unit with a projecting pair of binocular images of a remote object through a common lens system. Means are provided in the remote camera unit for inverting one of the two images and then causing the two images to be projected symmetrically onto the camera tube through the common lens system. Because of this image symmetry, distortion produced by the lens system or camera tube similarly affects both images. Means are provided in the image separation system of the viewing unit for transposing the transmitted inverted image and producing binocular separation of the images. Official Gazette of the U.S. Patent Office

N72-27729 National Lending Library for Science and Technology, Boston Spa (England).

ON THE THEORY OF HYSTERESIS LOSSES IN A ROTATING MAGNETIC FIELD

M. Kornetzki 7 May 1972 15 p refs Transl. into ENGLISH from Z. Physik (Berlin), v. 142, no. 70, 1955 p 70-82 (NLL-CE-Trans-5686-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Rotational hysteresis losses (A-rot) are greater than the alternating losses (A-osc) at low field strengths and less than the alternating losses at high field strengths. With reducing field strength A-rot/A-osc tends towards 2.3 and at saturation field strength, to zero. This variation can be explained theoretically if the reason for the hysteresis losses in small fields is assumed 2.3 and at saturation field strength, to zero. This variation can be explained theoretically if the reason for the hysteresis losses in small fields is assumed to be the movement of Bloch walls and the loss for each wall movement is described by Rayleigh's law. At high field strengths A-rot disappears because Bloch walls can no longer exist and because rotation of the magnetization against the crystal anisotropy is hysteresis-free. Formulas are given for the amplitude and angle of lag of the flux density in the case of rotating magnetization in the Rayleigh range in which these magnitudes depend on the Rayleigh factor for alternating field magnetization. Author

N72-27730*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.

CRYOGENIC RESEARCH AND DEVELOPMENT Progress Report, period ending 31 Mar. 1972

31 Mar. 1972 35 p refs

(NASA Order W-13300; NBS Proj. 27500-2750400; NBS Proj. 27503-2750430; NBS Proj. 27503-2750438; NBS Proj. 27505-2750550; NBS Proj. 27506-2750460) (NASA-CR-127275; PR-45; NBS-10-740) Avail: NTIS HC $3.75 CSCL 20L

Cryogenic properties of solids and slush hydrogen heat transfer are investigated, as well as hydrocarbon suspension. Solid hydrogen and slush hydrogen instrumentation are also studied. J.A.M.

N72-27731*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

CRYOGENIC GYROSCOPE HOUSING Patent Application

Wilhelm Angele, inventor (to NASA) Filed 13 Jun. 1972 10 p (NASA-Case-MFS-21136-1; US-Patent-Appl-SN-262430) Avail: NTIS HC $3.00 CSCL 20L

A cryogenic gyroscope housing having gas spin-up means provided in annular discs inserted between housing shells is reported. A circumferential recess in the inner edges of the discs at their juncture serves as the gas spin-up channel, and recesses in the discs at their junctures with the shells form suction channels. The discs also have inlet and outlet ports communicating with the spin-up channel and exhaust slots communicating with the suction channels. Mating surfaces of the discs and housing shells are held in position by optical contact at the equatorial plane of the housing. Suspension electrodes and thin-film readout loops are disposed in the shells. A centering band and clamp rings provide for proper alinement and placement of parts in formation of optical contact joints. NASA

N72-27732*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MAGNETIC DIPOLE MOMENT DETERMINATION BY NEAR-FIELD ANALYSIS

W. L. Eichhorn Washington Jul. 1972 87 p refs (NASA-TN-D-6685; G-1034) Avail: NTIS HC $3.00 CSCL 20C

A method for determining the magnetic moment of a spacecraft from magnetic field data taken in a limited region of space close to the spacecraft. The spacecraft's magnetic field equations are derived from first principles. With measurements of this field restricted to certain points in space, the near-field equations for the spacecraft are derived. These equations are solved for the dipole moment by a least squares procedure. A method by which one can estimate the magnitude of the error in the calculations is also presented. This technique was thoroughly tested on a computer. The test program is described and evaluated, and partial results are presented. Author

N72-27733# Joint Publications Research Service, Arlington, Va.

TRANSLATIONS ON EASTERN EUROPE - SCIENTIFIC AFFAIRS, NO. 250

16 Jun. 1972 35 p refs Transl. into ENGLISH from various Eastern European publications (JPRS-56289) Avail: NTIS HC $3.75

Research conducted in Hungary, Poland, Romania, and Yugoslavia is discussed. The topics include inspection of nuclear materials, gravitation and atoms, lasers, European space programs, atomic energy cooperation, flu vaccines, and the history of the Slovenian Ham Radio Society. K.P.D.

N72-27734*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

RESPONSE OF A SHROUD-ENCLOSED SPACECRAFT TO COMBINED ACOUSTIC-VACUUM ENVIRONMENTS

Lloyd R. Bruck Feb. 1972 29 p refs (NASA-TM-X-65922; X-320-71-518) Avail: NTIS HC $3.50 CSCL 20A

Tests were conducted in the launch phase simulator test facility, with the Orbiting Geophysical Observatory structural model and the Nimbus-type shroud being used as test items. Data are given for the acoustic vibratory response of the spacecraft as the ambient pressure external to the shroud was reduced. The results show that at most spacecraft locations, the

reduction in ambient pressure causes a significant reduction in the vibration response. There are, however, certain locations on the spacecraft and spacecraft adapter trusses where the reduction in ambient pressure has no effect. The differences in vibration responses obtained in this test can be directly related to two important factors: (1) excitation path - the path through which the external acoustic energy flows (either the mechanical path through structural members, or the air path directly from shroud to spacecraft); and (2) noise reduction of the shroud as a function of ambient pressure. As the pressure external to the shroud is reduced, the vented shroud has a corresponding decrease in internal pressure. The change in internal air density means less energy will be transmitted via the air path. Author

N72-27735*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ACOUSTIC RESPONSE COMPARISON FOR A SPACECRAFT TESTED WITH AND WITHOUT A SHROUD
Lloyd R. Bruck Feb. 1972 46 p refs
(NASA-TM-X-65921; X-320-71-517) Avail: NTIS HC $4.50 CSCL 20A

For the purpose of evaluating the simulation problems encountered in an acoustic environment laboratory, a research test program using the launch phase simulator was initiated. The Orbiting Geophysical Observatory (OGO) structural model and the Nimbus-type shroud were used as test items. Compared are the acoustic vibratory response of the OGO model when enclosed within a shroud with the OGO acoustical response with the shroud removed, while subjected to an equivalent acoustic environment. The results indicate that a shroud is necessary in order to perform a realistic acoustic test. Author

N72-27736*# Hughes Aircraft Co., Culver City, Calif.
METHOD AND APPARATUS FOR OPTICALLY MONITORING THE ANGULAR POSITION OF A ROTATING MIRROR Patent Application
Jack C. Lansing, Jr. and Richard W. Cline, inventors (to NASA) Filed 6 Jun. 1972 15 p
(Contract NAS5-11255)
(NASA-Case-GSC-11353-1; US-Patent-Appl-SN-260241) Avail: NTIS HC $3.00 CSCL 20F

An optical system monitors the angular position of a rotating scanning mirror to indicate the effective start and end of each scan. At a certain angular position, a ray of energy transmitted to the mirror is reflected a plurality of times between the reflectors associated with the optical system and the line on the mirror parallel to the axis thereof, and then to a detector to sense that angular position. A single optical system may be arranged to sense a plurality of different angular positions for each revolution of the mirror. NASA

N72-27737*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME CONTRIBUTIONS TO ENERGETICS BY THE LEWIS RESEARCH CENTER AND A REVIEW OF THEIR POTENTIAL NON-AEROSPACE APPLICATIONS
Robert W. Graham and Martin U. Gutstein 1972 11 p refs Proposed for presentation at Conf. on the Impact of Aerospace Technol. on Soc. in the 70's, Anaheim, Calif., 10-13 Sep. 1972; sponsored by Am. Soc. of Mech. Eng.
(NASA-TM-X-68092; E-6958) Avail: NTIS HC $3.00 CSCL 20L

The primary technology areas are aerospace propulsion, power and materials. As examples in these technologies, the programs in the fields of cryogenics and liquid metals are reviewed and potential non-aerospace applications for the results of these programs are discussed. These include such possibilities as: hydrogen as a non-polluting industrial fuel; more efficient central power stations; and powerplants for advanced ground transportation. Author

N72-27738# RAND Corp., Santa Monica, Calif.
WHAT COLOR IS GRAY?
Jeannine V. Lamar, Jami J. Simac, and Gary D. Haas (Stromberg Datagraphix, Inc.) Mar. 1972 11 p refs Presented at 10th Ann. Meeting of Users of Automatic Inform. Display Equipment (UAIDE), Los Angeles, 25-28 Oct. 1971 Submitted for publication
(P-4804) Avail: NTIS HC $3.00

If a black-and-white image is converted to a chromatic image, each shade of gray in the original becomes a different color in the pseudocolor transformation. The color in which gray is seen in the final image is a function of the densities of corresponding locations in the separations, the spectral content of the exposure light sources, and the exposures used during successive printing, in register, of the separations on color material. Problems encountered and techniques developed for generating separations on the Stromberg DatagraphiX 4060 are reported. Author

N72-27739*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HIGH SPEED SHUTTER Patent Application
James O. McClenahan, inventor (to NASA) Filed 30 Jun. 1972 15 p
(NASA-Case-ARC-10516-1; US-Patent-Appl-SN-267768) Avail: NTIS HC $3.00 CSCL 20F

A shutter element is formed by a loop of an electrically conductive ribbon disposed adjacent to the end of a passageway to be shuttered. The shuttered end of the passageway is cut at an acute angle. The two leg portions of the ribbon loop are closely spaced to each other and disposed in a plane parallel to the axis of the passageway. A pulse of high current is switched through the loop to cause the current flowing in opposite directions through adjacent leg portions of the ribbon to produce a magnetically induced pressure on one of the legs of the ribbon forcing the leg over the end of the passageway in gas tight sealing engagement therewith, thereby blocking same. NASA

N72-27740# Naval Underwater Systems Center, Newport, R.I.
PARAMETRIC RADIATOR THEORY 1
Mark B. Moffett 27 Sep. 1971 17 p refs
(AD-739321; NUSC-TM-PA4-234-71) Avail: NTIS CSCL 20/1

A derivation is given for the on-axis far-field difference-frequency pressure generated in a high-amplitude primary sound field composed of two components of differing frequencies. The primary field is a simplified model of the sound radiation from a plane piston. The secondary difference-frequency pressure field is determined by integration over the primary field. The cases considered include generation in both the collimated and spherically spreading zones of the primary with absorption and saturation limits in either zone. Author (GRA)

N72-27741# Technische Hochschule Darmstadt (West Germany). Lehrstuhl fuer Angewandte Physik.
QUANTITATIVE MEASUREMENTS OF THE EMISSION FROM HIGH DENSITY NANOSECOND SPARK CHANNELS Interim Scientific Report, 1 Feb. 1970 - 31 Jan. 1971
Heinz Fischer and Wilhelm Schwanzer Dec. 1971 26 p refs
(Contract F61052-68-C-0039)
(AD-739253; AFCRL-72-0069; ISR-2) Avail: NTIS CSCL 20/3

Quantitative values of the luminance and radiance at 4950 Angstrom were measured for Nanolite spark channels in the nanosecond range. The comparison standard was a crater of a low current carbon arc. Data of the Nanolite were: Capacitance, 1.35 nanofarads; Inductance, 2.1 microHenrys; Breakdown Voltage, 3.2 kilovolts; Gap, 0.65 mm; Pressure, 1 atmosphere. The maximum luminance was 20.0 watts per centimeter squared steradian Angstrom plus or minus 20 percent. The maximum radiance (at 4950 Angstrom) was 12.6 times ten to the sixth candlepower per centimeter squared, plus or minus 20 percent. Earlier observations demonstrated that the opacity in 1 atmosphere air during the current maximum is greater than 0.8. This opacity value is used to calculate the radiation temperature which was

31000 degrees Kelvin. Scaling laws are being derived for comparison with earlier observations in literature. These results compare rather well in spite of considerable simplifications used in the calculations. Author (GRA)

N72-27742# Hughes Aircraft Co., Culver City, Calif. Electronic Properties Information Center.

LINEAR ELECTRO-OPTIC MODULATOR MATERIALS: A BIBLIOGRAPHIC SUPPLEMENT

Jan. 1972 48 p refs

(Contract DSA900-72-C-1182)

(AD-739360; EPIC-SB-3) Avail: NTIS CSCL 20/6

154 citations and abstracts are given for the electro-optic, refractive index, transmission, dielectric constant, electrical resistivity, thermal conductivity, and expansion of thirteen electro-optic modulator materials. The references represent the input to the Electronic Properties Information Center storage and retrieval system for 1970 thru 1971 for the following materials: Ammonium Dihydrogen Arsenate (ADA), Ammonium Dihydrogen Phosphate (ADP), Barium Sodium Niobate, Bismuth Oxide-Germanium Oxide, Calcium Pyroniobate, Cuprous Chloride, Lithium Niobate, Lithium Tantalate, Potassium Dihydrogen Phosphate (KDP), Potassium Dihydrogen Arsenate (KDA), Potassium Tantalate Niobate (KTN) and Proustite, Silver Thioarsenide.

Author (GRA)

N72-27743# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INSTALLATION FOR STUDYING THE ELECTRIC BREAKDOWN MECHANISM OF AN ULTRAHIGH VACUUM

S. P. Bugaev, D. I. Proskurovskii, and V. I. Eshkenazi 18 Dec. 1971 9 p refs transl. into ENGLISH from Izv. Politekhn. Inst. (Tomsk, USSR), v. 162, 1967 p 186-189

(AF Proj. 7JJ)

(AD-739280; FTD-HT-23-1266-71) Avail: NTIS CSCL 20/3

The authors developed a device for studying the mechanism of electrical breakdown in an ultrahigh vacuum with the aid of high-voltage nanosecond pulses. A preliminary vacuum is achieved by means of zeolite pumps and further evacuation is accomplished with ion sorption pumps. The use of new greaseless pumping materials was occasioned by the fact that oil vapor films coating the electrodes can significantly affect the breakdown mechanism. Pressure was measured with an IM-12 triode ionization manometer. The metalloglass coaxial discharge chamber, with an inner diameter of 60 mm, withstood voltages up to 50 kv and passed pulses with a 1-nsec rise time without distortion. A general view of the device is presented as well as a diagram of the vacuum system, and breakdown initiation is described.

Author (GRA)

N72-27744# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STUDIES OF THE PHENOMENA OF MATERIAL TRANSFER FROM ELECTRODES DURING HIGH-VACUUM PULSE BREAKDOWN

V. I. Eshkenazi 30 Dec. 1971 11 p refs Transl. into ENGLISH from Izv. Politekhn. Inst. (Tomsk, USSR), v. 162, 1967 p 190-193

(FTD Proj. 7JJ)

(AD-739208; FTD-HT-23-1215-71) Avail: NTIS CSCL 20/3

A study was made of the breakdown of a 0.35 mm vacuum gap between a Cu cathode (surface with a Rogovskiy profile 44 mm in diameter) and a Mo anode (hemisphere 22 mm in diameter). The gap was set with an accuracy of 0.0005 cm. The electrical breakdown occurred at a given time. Using a shearing spark gap, it was possible to obtain marks from the breakdowns in an incomplete state of discharge after 12, 18, and 30 nsec. Growth on the anode of projections consisting of anode material and growth of micropeaks on the cathode at the expense of anode material was found. It is noted that as the discharge develops, the size of projections on the anode increases, as does the quantity of Mo being transferred to the cathode at the expense of evaporation of these projections. Author (GRA)

N72-27745# Israel Program for Scientific Translations, Ltd., Jerusalem.

PROPERTIES OF LIQUID AND SOLID HYDROGEN

B. N. Eselson, Yu. P. Blagoi, V. N. Grigorev, G. Manzhelii, and S. A. Mikhailenko 1971 127 p refs Transl. into ENGLISH of the handbook "Gosudarstvennaya Sluzhba Standartnykh i Spravochnykh Dannykh. Seriya: Spravochnye Obzory, no. 1" Moscow, Izdatelstvo Standardtov, 1969 136 p Sponsored in part by Dept. of Commerce, NBS, and NSF

(TT-70-50179) Avail: NTIS HC $3.00 CSCL 07D

The properties of liquid hydrogen as well as some of the most important properties of gaseous hydrogen at low temperature are given, particularly if it is impossible to draw a sharp boundary between liquid and gaseous hydrogen at low temperature are given, particularly if it is impossible to draw a sharp boundary between liquid and gaseous hydrogen at supercritical pressures. Thus, pressure, volume, and temperature data are given, as well as data on the specific heat, viscosity, and velocity of sound, over wide ranges of pressure and temperature.

Author (GRA)

N72-27746# Aerospace Corp., El Segundo, Calif.

FIRST AND SECOND MOMENTS OF AN OPTICAL WAVE PROPAGATING IN A RANDOM MEDIUM: EQUIVALENCE OF THE SOLUTION OF THE DYSON AND BETHE-SALPETER EQUATION TO THAT OBTAINED BY THE HUYGENS-FRESNEL PRINCIPLE Technical Report, Sep. - Oct. 1971

Harold T. Yura 31 Jan. 1972 24 p refs

(Contract F04701-71-C-0172)

(AD-739185; TR-0172(9230-10)-10; SAMSO-TR-72-67) Avail: NTIS CSCL 20/6

It is demonstrated, through terms of second order in the fluctuating part of the index of refraction, that the first and second statistical moment, as obtained from the Dyson and the Bethe-Salpeter equation, respectively, of a wave propagating in a random medium are identical to that obtained directly from the extended Huygens-Fresnel principle. Author (GRA)

N72-27747# GTE Sylvania, Inc., Mountain View, Calif. Electro-optics Organization.

EFFICIENT, HIGH GAIN PARAMETRIC GENERATION IN ADP CONTINUOUSLY TUNABLE ACROSS THE VISIBLE SPECTRUM

J. M. Yarborough and G. A. Massey 1971 12 p refs

(Contract N00014-69-C-0296)

(AD-739384) Avail: NTIS CSCL 20/6

Coherent visible light, continuously tunable over the range from 4200 A to 7300 A, has been obtained by pumping an ammonium dihydrogen phosphate (ADP) crystal with ultraviolet fourth harmonic of an Nd:YAG laser. Parametric gains sufficient to produce up to 25% average power conversion of the pump to the tunable visible output were obtained without the use of an external resonator. The output radiation typically had a 5A bandwidth, two nanosecond pulse duration, 100 kW peak power, and 5 mW average power at 30 pps. Wavelength tuning was accomplished either by varying the crystal temperature or its orientation with respect to the pump beam. Angle tuning allows the output to be rapidly tuned across the visible spectrum.

Author (GRA)

N72-27748# Georgetown Univ., Washington, D.C. Dept. of Physics.

THE EFFECTS OF STACKING FAULTS ON ULTRASONIC SURFACE WAVES

C. E. Springer Apr. 1972 146 p refs

(Contracts N00014-69-A-0220-0004; Nonr-5037(01))

(AD-739703) Avail: NTIS CSCL 20/1

A bounded ultrasonic beam in the MHz range is incident at the Rayleigh angle on a liquid-solid interface where it is double mode converted to a Rayleigh type wave and back to a longitudinal wave in the liquid. At the Rayleigh angle, and at specific frequencies, a large dip in the reflectivity curve has been

found, contrary to the theory which predicts total reflection under these conditions. In an effort to explain this dip, a system of coupled equations has been derived. It is based on the pinned string dislocation model of Granato and Lucke, but includes the additional effect of stacking faults present in the solid material. Author (GRA)

N72-27450 Brest Univ. (France). Faculte des Sciences.
GLOBAL CALCULATIONS OF CONCAVE GRATING ABERRATIONS AND OPTIMIZATION OF RESOLUTION WITH REGARD TO LUMINOSITY [CALCULS GLOBAUX DES ABERRATIONS DES RESEAUX CONCAVES ET DE L'OPTIMISATION DE LA RESOLVANCE PAR RAPPORT A LA LUMINOSITE]
A. Johannin-Gilles *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 171-181 refs In FRENCH (For availability see N72-27435 18-14)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also. 29 Space Radiation.

N72-27749 National Lending Library for Science and Technology, Boston Spa (England).
MICRO-WEIGHING, AN IMPORTANT SOURCE OF ERROR IN THE METROLOGY OF RADIOACTIVITY
Yves LeGallic [1972] 12 p refs Transl. into ENGLISH from French Rept. CEA-R-4169
(NLL-M-22443-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Effects of micro-weighting errors on radioactivity measurements are studied by evaluating the quality of the microbalances and the uncertainties observed in determinations of a solid mass. Intercomparisons of several Mettler-type microbalances for their repeatability, accuracy, and response magnitude in measuring the activity of a beta gamma emitter drop establish that the main source of error is attributable to the weighting process. G.G.

N72-27750*# Scientific Translation Service, Santa Barbara, Calif.
ON IONIZATION-RECOMBINATION OSCILLATIONS
V. P. Demutskiy and R. V. Polovin Washington NASA Jul. 1972 5 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 16, no. 9, Sep. 1971 p 1554-1556
(Contract NASw-2035)
(NASA-TT-F-14339) Avail: NTIS HC $3.00 CSCL 20H

A trap is investigated into which fast molecular ions are injected. It was found that the injection regime for fast ions and for fast neutrals is always stable. Author

N72-27751*# Scientific Translation Service, Santa Barbara, Calif.
COLLECTIVE OSCILLATIONS OF SPHERICALLY SYMMETRIC ROTATING MASS SYSTEMS
A. M. Fridman and I. G. Shukhman Washington NASA May 1972 9 p refs Transl. into English from Dokl. Akad. Nauk SSSR (Moscow), v. 202, no. 1, 1972 p 67-70
(Contract NASw-2035)
(NASA-TT-F-14413) Avail: NTIS HC $3.00 CSCL 20H

A class of stationary solutions of the original system of equations is given. The stability of a uniform sphere is proven, and the first frequencies of collective oscillations are computed. Author

N72-27752*# Scientific Translation Service, Santa Barbara, Calif.
INVESTIGATION OF FEYNMAN DIAGRAMS OF THE FIRST AND SECOND ORDERS FOR SOME STATES OF LIGHT ATOMS. 1: EXPRESSIONS FOR CONTRIBUTIONS FROM THE FIRST- AND SECOND-ORDER DIAGRAMS IN TERMS OF RADIAL INTEGRALS
U. I. Safronova and V. V. Tolmachev Washington NASA Feb. 1972 25 p refs Transl. into ENGLISH from Litovsk. Fiz. Sb. (USSR), v. 7, no. 1, 1967 p 53-72
(Contract NASw-2035)
(NASA-TT-F-14403) Avail: NTIS HC $3.25 CSCL 20H

The field form of pertubation theory is applied to the degenerate states of atoms. The diagram contributions for Del E are given in the first and second orders of perturbation theory. The moment projections have been summed completely. The diagram contributions are expressed by radial integrals. Author

N72-27753*# National Aeronautics and Space Administration, Washington, D.C.
A STUDY OF FEYNMAN DIAGRAMS OF THE FIRST TWO ORDERS FOR SOME STATES OF LIGHT ATOMS. 3: NUMERICAL CALCULATIONS OF CONTRIBUTIONS AND DIAGRAMS
U. I. Safronova, A. N. Ivanova, and V. V. Tolmachev May 1972 19 p refs Transl. into ENGLISH from Litovsk. Fiz. Sb. (USSR), v. 7, no. 2, 1967 p 303-319
(NASA-TT-F-14402) Avail: NTIS HC $3.00 CSCL 20H

Contributions by first and second order diagrams for 46 states of light atoms are calculated. Neglect of the diagrams of third, fourth, and higher orders is 0.13% of the experimental energy value for He, and 0.68% for Ne. The neglected diagrams of third and higher orders are 10% of the experimental difference value for the difference between ground and excited states. Author

N72-27754*# Techtran Corp., Glen Burnie, Md.
NUMERICAL CALCULATION OF HARTREE-FOCK DIAGRAMS OF FIRST AND SECOND ORDERS FOR ENERGY OF BASIC STATES OF LIGHT ATOMS IN FIELD FORMULATION OF PERTURBATION
A. Yu. Matulis, U. I. Safronova, and V. V. Tolmachev Washington NASA Feb. 1972 22 p refs Transl. into ENGLISH from Litov. Fiz. Sb. (USSR), v. 4, no. 3, 1964 p 331-346
(Contract NASw-2037)
(NASA-TT-F-14401) Avail: NTIS HC $3.25 CSCL 20H

The Hartree-Fock diagrams for ground state energies in the first and second orders of the field formation of perturbation theory were numerically studied. The Feynmann diagrammatic techniques for non-degenerate levels. The ground state energies for atoms from He to Ne were calculated. Author

N72-27755*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
OPTIMAL UTILIZATION OF TOTAL ELASTIC SCATTERING CROSS SECTION DATA FOR THE DETERMINATION OF INTERATOMIC POTENTIALS
R. B. Bernstein and R. A. LaBudde 18 Feb. 1972 39 p refs
(Grants NGL-50-002-001; NSF GB-16665)
(NASA-CR-127258; WIS-TCI-469) Avail: NTIS HC $4.00 CSCL 20H

The problem of inversion is considered in relation to absolute total cross sections Q(v) for atom-atom collisions and their velocity dependence, and the glory undulations and the transition to high velocity behavior. There is a limit to the amount of information available from Q(v) even when observations of good accuracy (e.g., + or - 0.25%) are in hand over an extended energy range (from thermal energies upward by a factor of greater than 1000 in relative kinetic energy). Methods were developed for data utilization, which take full advantage of the accuracy of the experimental Q(v) measurements. Author

N72-27756*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.

IMPULSIVE MODEL FOR REACTIVE COLLISIONS

Michael T. Marron and R. B. Bernstein 25 Feb. 1972 71 p refs

(Grants NGL-50-002-001; NSF GB-16665; NSF GP-26014)

(NASA-CR-127260; WIS-TCI-470) Avail: NTIS HC $5.75 CSCL 20H

A simple classical mechanical model of the reactive scattering of a structureless atom A and a quasi-diatomic BC is developed which takes full advantage of energy, linear and angular momentum conservation relations but introduces a minimum of further assumptions. These are as follows: (1) the vibrational degree of freedom of the reactant (BC) and product (AB) molecules is suppressed, so the change in vibrational energy is simply a parameter; (2) straight-line trajectories are assumed outside of a reaction shell; (3) within this zone, momentum transfer occurs impulsively (essentially instantaneously) following mass transfer; (4) the impulse, which may be either positive or negative, is directed along the BC axis, which may, however, assume all orientations with respect to the incident relative velocity. The model yields differential and total cross sections and product rotational energy distributions for a given collision exoergicity Q, or for any known distribution over Q. Numerical results are presented for several prototype reactions whose dynamics have been well-studied. Author

N72-27757*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.

ENTROPY AND CHEMICAL CHANGE. 1: CHARACTERIZATION OF PRODUCT (AND REACTANT) ENERGY DISTRIBUTIONS IN REACTIVE MOLECULAR COLLISIONS: INFORMATION AND ENTHROPY DEFICIENCY

R. B. Bernstein and R. D. Levine (Ohio State Univ.) 7 Mar. 1972 49 p refs Sponsored in part by AFOSR

(Grants NGL-50-002-001; NSF GP-26014)

(NASA-CR-127261; WIS-TCI-472) Avail: NTIS HC $4.50 CSCL 20H

Optimal means of characterizing the distribution of product energy states resulting from reactive collisions of molecules with restricted distributions of initial states are considered, along with those for characterizing the particular reactant state distribution which yields a given set of product states at a specified total energy. It is suggested to represent the energy-dependence of global-type results in the form of square-faced bar plots, and of data for specific-type experiments as triangular-faced prismatic plots. The essential parameters defining the internal state distribution are isolated, and the information content of such a distribution is put on a quantitative basis. The relationship between the information content, the surprisal, and the entropy of the continuous distribution is established. The concept of an entropy deficiency, which characterizes the specificity of product state formation, is suggested as a useful measure of the deviance from statistical behavior. The degradation of information by experimental averaging is considered, leading to bounds on the entropy deficiency. Author

N72-27758# Illinois Univ., Urbana. Dept. of Physics.

MULTI-PARTICLE SPECTRA IN SIMPLE THEORETICAL MODELS: A CLUSTER DECOMPOSITION ANALYSIS

David K. Campbell Jun. 1972 98 p refs

(Grant NSFGP-25303)

(ILL-(TH)-72-7) Avail: NTIS HC $7.00

An investigation is presented of inclusive and exclusive multiparticle spectra in several simple models of high energy hadronic interactions. Models designed to isolate the features arising from kinematic constraints are discussed for both pure longitudinal phase space and a longitudinal phase space modified to produce a leading particle effect. Examples of specific dynamical models are considered. The simplified Chew-Pignotti model, in both the strong-ordered and general versions, and a phi cubed-type multi-peripheral model were studied. A cluster decomposition approach was used, analogous to that used in statistical mechanics. A discussion of the possible extensions of these cluster techniques to phenomenological analyses of high energy interactions is also presented. Author

N72-27759*# National Aeronautics and Space Administration, Washington, D.C.

ION DISCRIMINATION IN MASS SPECTROMETERS

G. Careri and G. Nencini Jul. 1972 8 p refs Transl. into ENGLISH from Nuovo Cimento (Bologna), v. 7, no. 1, 1950 p 64-68

(NASA-TT-F-14326) Avail: NTIS HC $3.00 CSCL 20H

The efficiency of an ion source is considered as a function of the first accelerating voltage, of the gas pressure in the source, and perhaps of the mass. It was found that accurate measurements cannot be made by electric scanning. Author

N72-27760# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.

SUBTRACTION PIECE IN THE COTTINGHAM FORMULA FOR THE p-n MASS DIFFERENCE

Taizo Muta May 1972 26 p refs

(RIFP-148) Avail: NTIS HC $3.50

The possible absence is discussed of the J = 0 and I = 1 fixed pole and A sub 2 Regge pole terms in the longitudinal part of the p-n difference of the forward virtual Compton amplitude delta T sub L at least in the Bjorken scaling limit. An unsubtracted dispersion relation is presented for delta T sub L to show that the condition for the Cottingham formula to converge is R approximately = to q squared/2 nu squared in the scaling limit. The deep inelastic contribution to the p-n mass difference was estimated by use of the experimental data and was found to be too small to be able to reverse the wrong sign, unless a parameter appearing in the expression for R is large negative. Author

N72-27761*# Pittsburgh Univ., Pa. Dept. of Physics.

MULTIPHOTON EXCITATIONS IN VIBRATIONAL ROTATIONAL STATES OF DIATOMIC MOLECULES IN INTENSE ELECTROMAGNETIC FIELD

F. H. M. Faisal and Naseem K. Rahman (Am. Univ., Washington, D. C.) [1972] 12 p refs Supported in part A. W. Mellon Educational and Charitable Trust, the Maurice Falk Med. Fund, the Richard King Mellon Found., and the Sarah Mellon Scaife Found. Through the Space Res. Coord. Center

(Grant NGR-39-011-002)

(NASA-CR-127419) Avail: NTIS HC $3.00 CSCL 20H

A theory is presented and a calculational procedure is outlined for evaluating transition amplitudes of multiphoton excitations of vibrational-rotational levels in diatomic molecules. This theory can be utilized in studying behavior of molecules in intense electromagnetic fields. Author

N72-27762# Tokyo Univ. of Education (Japan). Dept. of Physics.

PION PION, PION KAON, AND KAON ANTIKAON DISTRIBUTIONS IN THE PIONIZATION REGION

Sunao Sakai [1971] 35 p refs

(TUEP-72-17) Avail: NTIS HC $3.75

Two particle distributions are investigated in the multiperipheral model which has succeeded to fit the single particle distributions. The distribution functions in the pionization region are studied. Results show that there is the cutoff with respect to k sub 1 perpendicular squared, k sub 2 perpendicular squared and (k sub 1 perpendicular +k sub 2 perpendicular) squared, where k sub 1 and k sub 2 are four momentums of produced particles. Our results indicate that the correlations are stronger in pion,pion - than kaon, negative kaon - channel and the correlation has the k squared perpendicular dependence. Namely the stronger correlations are seen in the small k perpendicular squared region than large k perpendicular squared region. The comparison with the experimental data on longitudinal rapidity distributions and rapidity correlations are also discussed. The qualitative features agree with our result. Author

N72-27763*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HYDROGEN AS AN ATOMIC BEAM STANDARD
H. E. Peters Jun. 1972 14 p refs Submitted for publication
(NASA-TM-X-65932; X-524-72-210) Avail: NTIS HC $3.00 CSCL 20H

After a preliminary discussion of feasibility, new experimental work with a hydrogen beam is described. A space focused magnetic resonance technique with separated oscillatory fields is used with a monochromatic beam of cold hydrogen atoms which are selected from a higher temperature source. The first resonance curves and other experimental results are presented. These results are interpreted from the point of view of accuracy potential and frequency stability, and are compared with hydrogen maser and cesium beam capabilities. Author

N72-27764# Maryland Univ., College Park. Center for Theoretical Physics.
RIGOROUS BOUNDS ON COUPLING CONSTANTS IN TWO DIMENSIONAL FIELD THEORIES
Michael Creutz Jul. 1972 8 p refs
(Grant NSF GU-2061)
(TR-73-003) Avail: NTIS HC $3.00

It is shown that renormalized three particle coupling constants in a field theory with one space and one time dimension are bounded. This bound depends on the particle spectrum and assumes only analyticity, crossing, unitarity, and polynomial boundedness of the S matrix at infinity. Author

N72-27765# Maryland Univ., College Park. Center for Theoretical Physics.
RADIAL EFFECTS IN THE SYMMETRIC QUARK MODEL Ph.D. Thesis
Triptesh De, Y. S. Kim, and Marilyn E. Noz Jun. 1972 23 p refs
(Grant NSF GP-8748)
(TR-72-122) Avail: NTIS HC $3.25

Effects of the radial wave function are studied for the non-strange baryons in the symmetric quark model. Rotational energy levels are calculated and are found to be in agreement with the energy levels in the observed baryonic mass spectra. Relativistic perturbative effects which vanish in the large quark mass limit are also calculated. The lower bound on the quark mass is found to be approximately 1.5 GeV. Author

N72-27766# Maryland Univ., College Park. Center for Theoretical Physics.
RADIAL EXCITATIONS IN THE SYMMETRIC QUARK MODEL
Y. S. Kim and Marilyn E. Noz Apr. 1972 10 p refs
(Grant NSF GP-8748)
(TR-72-088) Avail: NTIS HC $3.00

Radial excitation modes are analyzed for non-strange baryons. It is found that the baryon radial mode exhibits a harmonic oscillator-like mass spectrum with the energy spacing of 270 MeV. It is shown that a large SU(6) force is responsible for this narrow spacing. It is shown also that this SU(6) force is responsible for the exceptionally low mass of the Roper resonance. Author

N72-27767# Maryland Univ., College Park. Center for Theoretical Physics.
MONOPOLE THEORY WITH POTENTIALS
Patrizio Vinciarelli Jul. 1972 11 p refs
(Grant NSF GU-2061)
(TR-72-129) Avail: NTIS HC $3.00

The Cabiddo-Ferrari two potentials formalism is used to construct a representation of the gauge-independent electrically and magnetically charged Mandelstam field. This representation is applied to convert the Cabiddo-Ferrari-Coleman formulation of monopole theory into a more conventional one in terms of gauge-dependent fields and potentials. Author

N72-27768# Maryland Univ., College Park. Center for Theoretical Physics.
A RENORMALIZABLE MODEL OF WEAK AND ELECTROMAGNETIC INTERACTIONS WITH CP-VIOLATION
Rabindra N. Mohapatra Apr. 1972 12 p refs
(Grant NSF GP-8748)
(TR-72-084) Avail: NTIS HC $3.00

A renormalizable gauge field model of weak and electromagnetic interaction of leptons and hadrons is constructed. The model can explain CP-violation in hadronic weak processes and the suppression of hadronic neutral currents. Author

N72-27769# Rome Univ. (Italy). Inst. of Physics.
NONLINEAR LEE MODEL 2
F. Calogero 9 Feb. 1972 60 p refs Submitted for publication
(Nota-Interna-356) Avail: NTIS HC $5.00

The exact solutions of a nonlinear Lee model in some sectors of its Hilbert space are explicitly displayed. The solutions are similar to, but somewhat richer than, the corresponding solutions of the usual Lee model. The N, V-N (theta), NN, VN-NN(theta) sectors are treated in detail. ESRO

N72-27856* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PREVIOUS DESIGN RESTRAINTS AND RADIATION DAMAGE EFFECTS OF LOW ENERGY PARTICLES
James H. Trainor *In* JPL Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 129-142 refs (For availability see N72-27850 18-30)
CSCL 20H

N72-27857* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DERIVATION OF MISSION FLUENCES FROM FLUX MODELS: PROPAGATION OF UNCERTAINTIES
Jack Barengoltz *In its* Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 143-158 (For availability see N72-27850 18-30)
(Contract NAS7-100)
CSCL 20H

N72-27858* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EFFECTS OF ELECTRONS AND PROTONS ON SCIENCE INSTRUMENTS
Richard H. Parker *In its* Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 159-177 refs (For availability see N72-27850 18-30)
(Contract NAS7-100)
CSCL 20H

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N72-27770*# California Univ., Los Angeles. Plasma Physics Group.
STRUCTURE OF ION ACOUSTIC SOLITONS AND SHOCK WAVES IN A TWO COMPONENT PLASMA
Roscoe B. White, Burton D. Fried, and Ferdinand V. Coroniti Sep. 1971 29 p refs
(Grants NGR-05-007-190; NGR-05-007-116; Contracts N00014-69-A-0200; AT(04-3)-34; Grant NSF GP-22817)
(NASA-CR-127387; AD-731412; PPG-100) Avail: NTIS HC $3.50 CSCL 20I

Time-independent solitary waves and shocks were investigated in a two-component plasma using a fluid model and kinetic theory. It was found that very small concentrations of a light ion can alter the structure, changing the potential maximum

by an order of magnitude. The downstream oscillatory structure normally seen in a shock is completely quenched by dissipation due to light ion reflection at concentrations of 3 to 8% in an argon plasma for typical T sub e/T sub i and Mach number values. Author

N72-27771*# California Univ., Los Angeles. Dept. of Physics.
CROSS FIELD CURRENT DRIVEN ION ACOUSTIC INSTABILITY
P. J. Barrett, B. D. Fried, C. F. Kennel, J. M. Sellen, and R. J. Taylor Dec. 1971 16 p refs Prepared in cooperation with TRW Systems, Redondo Beach, Calif.
(Grants NGR-05-007-190; NGR-05-007-116; Contracts N-00014-69-A-0200; AT(04-3)-34; Grant NSF GP-22817)
(NASA-CR-127272; AD-734692; PPG-94) Avail: NTIS HC $3.00 CSCL 20H

The ion acoustic instability occurs when electrons and ions have a relative streaming velocity, along x and with ion drift velocity greater than ion acoustic velocity, across a weak magnetic field, B sub z. If (k sub x)(r sub ci) is much greater than 1 and the frequency is much less than the electron cyclotron frequency, the spatial growth rate is enhanced by a factor (k sub x)/(k sub z) over the value at zero magnetic field. Measurements of the growth rate were carried out in two different plasma configurations as a function of both the magnetic field and the ion acoustic frequency. The results are consistent with the linear dispersion relation for this instability. Author

N72-27772# Kyoto Univ. (Japan). Dept. of Aeronautical Engineering.
IONIZATION RELAXATION IN SHOCK HEATED ARGON
Goro Kamimoto, Koji Teshima, and Masaharu Nishimura Apr. 1972 64 p refs
(CP-36) Avail: NTIS HC $5.25

The relaxation profiles of an ionizing shock wave argon were studied both theoretically and experimentally. In the calculation, the ionization of argon occurs in a multistep process, and the results are compared with those obtained with the usual two-step ionization model. Emitted radiation from shock-produced argon plasma was measured using spectrometers, and the relaxation profiles of the population densities in three excitation levels of the argon atom were obtained. The resonance line of argon was measured with a vacuum-ultraviolet spectrometer to obtain the relaxation profile of the population density in the level 3p5 4s. A windowless shutter was developed to couple the spectrometer to the shock tube. Author

N72-27773# Kyoto Univ. (Japan). Dept. of Aeronautical Engineering.
DETERMINATION OF THERMODYNAMIC PROPERTIES OF SHOCK PRODUCED ARGON PLASMA
G. Kamimoto and K. Teshima Jan. 1972 19 p refs
(CP-33) Avail: NTIS HC $3.00

The electron temperature and density were measured by a spectroscopic technique. The electron temperature was determined by an intensity ratio of line and continuum, and the electron density was determined by the continuum intensity and calibrated by the result of the microwave reflection probe measurements. These values at the ionization equilibrium agree with the calculations within experimental errors and ones resulting from the uncertainties in the radiation theory. Decay of the radiation is explained by decreases of the electron density due to the radiation energy loss from the plasma. Author

N72-27774# Kyoto Univ. (Japan). Dept. of Aeronautical Engineering.
IONIZATION RELAXATION STUDY OF SHOCK HEATED ARGON WITH MICROWAVE REFLECTION PROBE TECHNIQUE
G. Kamimoto and K Teshima Jan. 1972 32 p refs
(CP-32) Avail: NTIS HC $3.75

A microwave reflection probe method was applied to measurements of electron densities in ionization relaxation zone behind shock waves in argon. In order to check the instrumentation and to investigate the ionization processes, measurements were also made at different impurity levels. The residual gases in the shock tube, air in the atmosphere, oxygen, and nitrogen were chosen as impurities. Author

N72-27775# Kyoto Univ. (Japan). Dept. of Aeronautical Engineering.
STUDY OF PRECURSOR PHENOMENA AHEAD OF IONIZING SHOCK WAVES
G. Kamimoto and K. Teshima Jan. 1972 30 p refs
(CP-31) Avail: NTIS HC $3.50

Precursor densities were measured, and the following results were obtained: (1) both electrons and ions exist and the electron density is larger than ion density; (2) the electron density profile is consistent with that expected by free diffusion at relatively high temperature, whereas the ion density decay length is shorter than that of the electrons and is much longer than that expected by free diffusion of ions; and (3) photoemission effects on precursor density is negligible. Electron density in relatively high precursor density was measured using Langmuir theory and by an oscillating potential probe technique. The electron temperatures ranged from 8000 to 20,000 K, a reasonable range considering heat conduction and/or electron diffusion. Precursor density differs very much in impurity levels of the test gas. Based on experimental results in relatively low impurity levels, it is suggested that the precursors result from the ambipolar diffusion immediately behind the shock front, and then diffuse forward almost freely. Author

N72-27776*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
PLASMA ENTRY INTO THE EARTH'S MAGNETOSPHERE
L. A. Frank May 1972 34 p refs For presentation at the 1972 COSPAR Symp. on Critical Probl. of Magnetospheric Phys.
(Contracts NAS5-10625; NAS1-8141; NAS1-2973; NAS5-9074; NAS5-11039; Grant NGL-16-001-002; Contract N00014-68-A-0196-0003)
(NASA-CR-127424; U-of-Iowa-72-9) Avail: NTIS HC $3.75 CSCL 20I

Both high- and low-altitude measurements are used to establish the salient features of the three regions presently thought to be the best candidates for the entry of magnetosheath plasma into the magnetosphere, and hence the primal sources of charged particles for the plasma sheet and its earthward termination in the ring current. These three regions are (1) the polar cusps and their extensions into the nighttime magnetosphere, (2) the downstream flanks of the magnetosphere at geocentric radial distances approximately equal to 10 to 50 earth radii along the plasma sheet-magnetosheath interface, and (3) the distant magnetotail at radial distances greater than or approximately equal to 50 earth radii. Present observational knowledge of each of these regions is discussed critically as to evidences for charged particle entry into the magnetosphere from the magnetosheath. The possibility that all three of these magnetospheric domains share an intimate topological relationship is also examined. Author

N72-27777# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
ELECTROSTATIC SINGULARITY IN A PLASMA IN A MAGNETIC MIRROR FIELD
Hans Persson 22 Apr. 1972 15 p refs Submitted for publication
(TRITA-EPP-72-10) Avail: NTIS HC $3.00

Stationary states of a collisionless plasma in a magnetic mirror field are vonsidered and the role of singularities is investigated. Velocity distributions giving singularities may for instance be produced by a current flow along the magnetic field. A physical interpretation in terms of supersonic motion in the nozzle formed by the magnetic field is discussed. The condition

of quasineutrality is assumed in an attempt to determine the conditions for shock formation in the flow of particles against the obstacles constituted by the converging magnetic field. On the basis of the results it is suggested that sheath, or shock-like transitions connected with field-aligned currents in a converging magnetic field may be important both in laboratory devices and in space, for the properties of precipitating auroral particles.
ESRO

N72-27778# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
ON THE FORMATION OF DOUBLE LAYERS IN PLASMAS
Per Carlqvist Apr. 1972 21 p refs Submitted for publication
(TRITA-EPP-72-09) Avail: NTIS HC $3.25

A homogeneous plasma carrying a constant current is considered. It is demonstrated that the plasma is unstable if the current density exceeds a critical value which depends both on the plasma density and on the thermal energies of the ions and of the electrons in the plasma. A small one-dimensional disturbance in the form of a density dip will then give rise to a progressive local evacuation of the plasma. When the particle density in the dip has been reduced to a certain limit a double layer forms in the evacuated region. The stability of such a double layer is briefly discussed. The occurrence of double layers in the ionosphere and in the solar atmosphere is considered.
Author (ESRO)

N72-27779# RAND Corp., Santa Monica, Calif.
SOVIET PROGRESS IN PHYSICS: REVIEWS OF CURRENT RESEARCH
Simon Kassel, ed. Sep. 1971 42 p refs
(Contract DAHC15-67-C-0141; ARPA Order 189)
(AD-739324; R-793-ARPA) Avail: NTIS CSCL 20/9

Contents: Generation of plasma in free air; Explosive electron emission; Super-strong pulsed magnetic fields; Laser induced high temperature superconductivity; Optical explosions.
GRA

N72-27780# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN CHARACTERISTICS OF DISCHARGE IN A NONUNIFORM AND TRANSVERSE MAGNETIC FIELD
S. P. Martynyuk and V. M. Tkacherko 15 Dec. 1971 8 p refs Transl. into ENGLISH from Ukrayinskyi Fizychnyi Zh. (USSR), v. 14, no. 4, 1969 p 693-696
(AD-739290; FTD-HT-23-1173-71) Avail: NTIS CSCL 20/9

Gas discharge in crossed electric and magnetic fields was studied in relation to concepts of confinement of high-temperature plasma, generation of electromagnetic oscillations, and commutation of high-energy currents. Electrodes in coaxial cylinders, with a fixed axial discharge symmetry during superposition of the magnetic field, were used. Results showed that the ignition voltage and the magnitude of the discharge current can be changed by means of magnetic fields.
Author (GRA)

N72-27781# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHENOMENA OF TRANSFER IN LOW-TEMPERATURE PLASMA (SELECTED ARTICLES)
30 Dec. 1971 49 p refs Transl. into ENGLISH from "Yavleniya Perenosa v Nizkotemperaturnoi Plazme" Moscow, 1969 p 186-197, 202-207, and 225-234
(AD-738739; FTD-MT-24-1030-71) Avail: NTIS CSCL 20/9

Contents: The diffusion of vapors of alkaline metals in inert gases; Machine-less jet installations (with liquid MGDG); Development of the method for the investigation of the boundary layer in a high-temperature gas.
GRA

N72-27782# Miami Univ., Coral Gables, Fla. Dept. of Physics.
OPTICAL INTERFEROMETERS APPLIED TO THE DIAGNOSTICS OF PLASMAS Final Scientific Report, 1 Jan. 1968 - 31 Dec. 1971
Joseph G. Hirschberg 28 Feb. 1972 194 p refs
(Grant AF-AFOSR-1496-68; AF Proj. 9751)
(AD-738633; AFOSR-72-0571TR) Avail: NTIS CSCL 20/9

The report describes developments of the Optical Physics Laboratory of the University of Miami which was principally supported by the Grant during the years 1968 through 1971. The various projects of the Laboratory, principally the Multichannel Fabry-Perot, density interferometers, high atmosphere measurements, laboratory plasma studies, solar eclipse study, multiplex Fabry-Perot interferometer and Fabry-Perot duochromator are described. Publications pertaining to these and other activities of the Laboratory are listed, and a number of them are included in full.
Author (GRA)

N72-27783# Army Electronics Command, Fort Monmouth, N.J.
TIME AND SPACE RESOLVED MEASUREMENT OF THE GAS TEMPERATURE AND ITS DECAY IN AFTERGLOW DISCHARGES
R. G. Buser and J. Kainz Sep. 1971 27 p refs
(DA Proj. 1T0-61102-B-31-A)
(AD-739491; ECOM-3467) Avail: NTIS CSCL 20/9

Using the temperature dependence of the line absorption, a method is described which permits the determination of the gas temperature profile and its decay. The measurement itself involves the determination of the line absorption with a mirror and a probing source. Theoretically, approximated expressions are derived for multiple layered media, and for thin layers the corresponding equations are given rigorously. The concept has been tested for the case of pulsed helium afterglows, and the results show satisfactory agreement with acoustically determined temperatures.
Author (GRA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N72-27784* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LIGHT REGULATOR Patent
Jerry G. Williams and Joseph H. Judd, inventors (to NASA) Issued 20 Jun. 1972 3 p Filed 28 Apr. 1971 Supersedes N72-11653 (10 - 02, p 0237)
(NASA-Case-LAR-10836-1; US-Patent-3,671,105; US-Patent-Appl-SN-138227; US-Patent-Class-350-161) Avail: US Patent Office CSCL 20L

A thin absorbing metallic film is described which is deposited on a low modulus transparent substrate as well as a mechanism for stretching the substrate. As the substate is stretched, the thickness of the thin film decreases and microfractures occur, allowing an increase in transmission of visible light through the thin film.
Official Gazette of the U.S. Patent Office

N72-27785 National Lending Library for Science and Technology, Boston Spa (England).
STUDY OF THE EFFECT OF THE MAGNETIC STATE AND OF THE THICKNESSES OF THIN NICKEL FILMS ON MAGNETOELASTIC PROPERTIES: TEST RESULTS
Jean-Claude Lecordier and A. Colombani 4 Apr. 1972 7 p refs Transl. into ENGLISH from Compt. Rend. Acad. Sci. (Paris), Ser. B, v. 273, 20 Sep. 1971 p 501-504 In FRENCH and ENGLISH
(NLL-LTI-746-1160-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The elastoresistant coefficients of thin nickel films depend on both their magnetic state and their thickness. When relative lengthening undergone by the film increases, for an initial given

magnetic state, large variations in the extensometric coefficients can be observed principally when the thickness is near 670 A (for the longitudinal effect) and 680 A (for the transverse). Experimental results are presented for irreversible resistivity transformations in films under constraints. Transl. by K.P.D.

N72-27786 National Lending Library for Science and Technology, Boston Spa (England).

STUDY OF THE EFFECT OF THE MAGNETIC STATE OF THIN FILMS OF NICKEL ON MAGNETOELASTIC PROPERTIES

Jean-Claude Lecordier and A. Colombani 4 Apr. 1972 8 p refs Transl. into ENGLISH from Compt. Rend. Acad. Sci. (Paris), Ser. B, v. 273, 6 Sep. 1971 p 361-364 In FRENCH and ENGLISH

(NLL-LTI-746-1159-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Elastoresistant properties of thin nickel films measured in the absence of induction are strongly influenced by their magnetic state. The gage coefficients of the films are variable with respect to orientation, the value of induction applied previously to the films, and the amplitude of relative lengthening. Transl. by K.P.D.

N72-27787 National Lending Library for Science and Technology, Boston Spa (England).

REPRESENTATION OF UN-CONSERVATIVELY MOVED DISLOCATIONS BY LINEAR SOURCES OF VACANCIES

V. T. Zhaden and B. A. Vershok [1972] 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), v. 1, 1972 p 76-80

(NLL-M-21377-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A dislocation containing discrete sources of vacancies is represented by a continuous source of vacancies. Equations describing the steady nonconservative movement of dislocation systems were solved. Author

N72-27788 National Lending Library for Science and Technology, Boston Spa (England).

TEMPERATURE FUNCTION OF THE SPEED OF SOUND AND THE STRUCTURE OF METALLIC LIQUIDS

C. N. Kalistratov and S. I. Filippov [1972] 6 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met. (Moscow), v. 1, 1972 p 5-8

(NLL-M-21371-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Temperature dependence of the speed of sound is considered for molten Cu, Zn, Sn, Sb, and Zn3Sb2. The effect of crystal structure type on temperature dependence is discussed. K.P.D.

N72-27789 National Lending Library for Science and Technology, Boston Spa (England).

THE SIGNIFICANCE OF RESISTIVITY CHANGES CAUSED BY ADSORPTION OF GASES ON THIN METALLIC FILMS

G. Wedler and P. Wissmann 4 Apr. 1972 12 p refs Transl. into ENGLISH from Surface Sci. (Amsterdam), no. 26, 1971 p 389-396 In ENGLISH and GERMAN

(NLL-Trans-746-1194-(9022.401)) Copyright. Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The variation of the electrical resistance of thin metal films due to adsorption of gases is discussed in regard to coverage and thickness dependence. Experimental results available for the systems Ni/CO, Au/CO, Ni/H2, Cu/CO, Ni.O2, Fe/N2, and Ni/N2 are given. For all systems the adsorption produces an increase in the resistance, which can be explained quantitatively by means of the scattering theory. According to this theory the adsorbed particles act as scattering centers for the conduction electrons similar to alloyed atoms inside the metal. A correlation is found between the increase in resistance and the strength of the adsorption. Author

N72-27790# General Electric Co., Schenectady, N.Y. Superconductive Materials Data Center.

PROPERTIES OF SELECTED SUPERCONDUCTIVE MATERIALS

B. W. Roberts Washington NBS Jun. 1972 100 p refs Supersedes NBS-TN-482

(Contract NBS-32-70-5)

(NBS-TN-724; NBS-TN-482) Avail: SOD $1.00 as C 13.46:724

Data on superconductive materials are presented which were extracted from the literature published up to early 1971. The properties concerned are composition, critical temperature, critical magnetic fields, crystallographic data, and the lowest temperature tested for materials specifically explored for superconductivity. The compilation also includes a bibliography, a list of general review articles, and a special tabulation of high magnetic field superconductors. Author

N72-27791# Electrotechnical Lab., Tokyo (Japan).

ACOUSTOELECTRIC EFFECTS IN III-V COMPOUND SEMICONDUCTORS

Hisao Hayakawa Apr. 1972 104 p refs In JAPANESE; ENGLISH summary

(RR-725) Avail: NTIS HC $7.25

Various phenomena caused by acoustoelectric interactions in III-V compound semiconductors, such as InSb and GaAs, were investigated. Piezoelectric, ultrasonic and physical properties of the semiconductors are presented. The acoustoelectric current oscillations in n-GaAs and n-InSb are described. The experimental results and the theoretical treatments of the amplification of ultrasonic waves with the frequency range of 15 to about 465 MHz in n-InSb under the transverse magnetic field are considered. A method and experimental results on dc operation of the ultrasonic amplification in n-InSb and n-GaAs are also given. The generation of ultrasonic waves in the frequency range up to the microwave region by using the GaAs Gunn effect diode is described. A method is described for the efficient detection of the high frequency ultrasonic waves using a subcritically doped GaAs bulk diode which is biased by a high electric field. Experimental studies on the generation and detection of surface elastic waves on LiNbO3 by GaAs bulk effect diodes are described. The experimental study of the amplification of surface waves in the transverse magnetic field by using-n InSb which is placed onto a LiNbO3 surface is also described. Author

N72-27792*# Isomet Corp., Oakland, N.J.

SINGLE CRYSTALS OF SELECTED TITANATES AND TUNGSTATES Final Report

G. M. Loiacono 6 Jun. 1972 51 p refs

(Contract NAS3-15327)

(NASA-CR-120949; ISO-5166-72) Avail: NTIS HC $4.75 CSCL 20B

The compound preparation and crystal growth of a number of mixed titanate compositions was investigated. None of the compounds studied were found to melt congruently and therefore, crystal growth was extremely difficult. Various single crystal preparation methods always resulted in mixed phases from which 1-2 mm size crystals could be separated. It is concluded from this study that before successful single crystal growth can be accomplished, a detailed stucy of the phase diagrams in each of the systems of interest must be completed. Author

N72-27793# Technische Hogeschool, Delft (Netherlands).

MOSSBAUER EFFECT STUDIES OF SUPERPARAMAGNETIC ALPHA-FeOOH AND ALPHA-Fe2O3 Ph.D. Thesis

Adrianus Michiel VanDerKraan 1972 121 p refs

Avail: NTIS HC $8.25

Analysis were made of the Mossbauer effect in utrafine alpha-Fe2O3 and alpha-FeOOH crystallites. Data cover: (1) different types of Mossbauer spectrometers, (2) theories dealing with the interaction of a nucleus in a solid and its environment, (3) superparamagnetism and the influence of fast electron spin relaxation on Mossbauer spectra shape, (4) effect of temperature

and external magnetic field on alpha-FeOOH and alpha-Fe2O3 Mossbauer effect measurements, and (5) methods to enrich the surface layers of ultrafine alpha-Fe2O3 particles in Fe-57.
E.H.W.

N72-27794# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
INDIRECT COOLING OF SUPERCONDUCTING Nb-Ti INTRINSICALLY STABILIZED MAGNET COILS
W. Eschricht, H. J. Fiebig, G. Horlitz, U. Knopf, G. Knust, K. D. Nowakowski, O. Peters, W. Stahlschmidt, and S. Wolff Oct. 1971 28 p refs
(DESY-71/57) Avail: AEC Depository Libraries
A simple method of indirect cooling of superconducting coils is described. Intrinsically stabilized conductors were successfully operated while being cooled by heat conduction over a distance of twenty-six centimeters between conductor and heat exchanger. Author (NSA)

N72-27795# Royal Inst. of Tech., Stockholm (Sweden).
COLLISIONAL BROADENING OF LANDAU LEVELS IN A POLAR SEMICONDUCTOR
Bo Magnusson [1971] 26 p refs
Avail: NTIS HC $3.50
Higher order effects on collision broadening of Landau levels are calculated. The collision frequency is calculated for an elastic process and for polar optical phonon scattering in a semiconductor. It is shown how the collision frequency as a function of the wave vector is modified by the theory. The validity of the Boltzmann equation is insured with a minor modification in the collision term. Author (ESRO)

N72-27796# Royal Inst. of Tech., Stockholm (Sweden).
LOW FIELD TRANSPORT PROPERTIES OF A POLAR SEMICONDUCTOR IN A QUANTIZING MAGNETIC FIELD
Bo Magnusson 1972 32 p refs
Avail: NTIS HC $3.75
Distribution functions were analytically and numerically calculated for parallel strong magnetic and weak electric fields in a polar semiconductor. The distribution functions exhibit discontinuities at certain values of the momentum. The extrema in the magnetoresistance are displaced, relative to the magnetophonon resonance points, to higher magnetic field values when the temperature increases and the elastic scattering mechanisms become stronger. An explanation of this behavior is given, based on the effective relaxation time for the electrons in the lowest Landau level. Author (ESRO)

N72-27797# Royal Inst. of Tech., Stockholm (Sweden).
TRANSPORT PROPERTIES OF A POLAR SEMICONDUCTOR IN A QUANTIZING MAGNETIC FIELD
Bo Magnusson 1 Oct. 1971 37 p refs
Avail: NTIS HC $4.00
Momentum distribution functions for electrons are calculated for a polar semiconductor with parallel applied electric magnetic fields. The derivative of the distribution function has singularities at certain electron energies due to the singularity in the density of states at zero energy. The interaction between the Landau levels sometimes leads to a double hump in the distribution function. ESRO

N72-27798# Texas Univ., Arlington. Electronics Research Center.
A STUDY OF MAGNETIC TRANSITION PROPERTIES IN THE CoS(2-x)Se(x) FAMILY USING PYROMAGNETIC DETECTION METHOD
Tim Lin, R. W. Bene, and R. M. Walser 11 Jan. 1972 55 p refs
(Contract N00014-67-A-0126-0014)
(AD-739336; TR-117) Avail: NTIS CSCL 20/12
Two different kinds of the pyromagnetometer are built to study the pyromagnetic transition properties of the CoS(2-x)Se(x) family. Data, such as angular dependence, composition dependence, incident radiation intensity dependence, and external magnetic bias field dependence of the pyromagnetic response of this series, are obtained. The results on CoS(2-x)Se(x) are compared with those on Gd which is presently the most promising material for pyromagnetic radiation detection.
Author (GRA)

N72-27799# Hughes Aircraft Co., Culver City, Calif. Electronic Properties Information Center.
THE II-VI TERNARY COMPOUNDS DATA TABLES
M. Neuberger Jan. 1972 103 p refs
(Contract DSA900-72-C-1182)
(AD-739359; EPIC-S-15; LC-71-189484) Avail: NTIS CSCL 20/12
The groups II-VI ternary semiconducting compounds are of technological device importance as cathode-ray tube screens, infrared detectors, display devices, injection lasers, solar cells and image intensifiers. These tables include the most reliable property information available to date for these compounds, including mechanical, crystallographic, physical, thermal, magnetic, electronic and optical data. Author (GRA)

N72-27800# Georgia Univ., Athens. Dept. of Physics and Astronomy.
MAGNETIC PHASE TRANSITIONS IN THE PRESENCE OF EXTERNAL MAGNETIC FIELDS Final Report
John E. Rives 1 Mar. 1972 16 p refs
(Grant AF-AFOSR-1545-68; AF Proj. 9764)
(AD-739259; AFOSR-72-0536TR) Avail: NTIS CSCL 20/12
Measurements of some static and dynamic properties of several insulating magnetic compounds near magnetic phase transitions have led to a better understanding of the nature of such transitions. High resolution specific heat, differential susceptibility, and heat transport studies have all been used in this investigation. Author (GRA)

N72-27801# National Bureau of Standards, Washington, D.C.
PHOTOEMISSION PROPERTIES OF ALUMINUM OXIDE AND EVAPORATED ALUMINUM FILMS
Richard Y. Koyama Jan. 1972 30 p refs
(Contract PRO-Y-72-827; AF Proj. 5621)
(AD-739198; SR-3; AFCRL-72-0037) Avail: NTIS CSCL 20/12
Measurements of the photoemission energy distributions and quantum yield for anodically grown aluminum oxide are presented. At photon energies greater than 25 eV, the emitted spectrum consists mostly of inelastically scattered electrons. Also measured is the yield dependence on the angle of incidence. Measurements of the energy distributions from evaporated aluminum films show a significant number of primary electrons (relative to the secondaries). However, evidence suggests that the evaporated film was contaminated either by the oxide of the substrate or from oxygen in the existing vacuum. Author (GRA)

N72-27802# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EVALUATION OF THE LORENTZ NUMBER IN SEMICONDUCTORS
B. N. Khusainova 18 Dec. 1971 11 p refs Transl. into ENGLISH from Moscow Univ. Vestnik (USSR), no. 3, 1968 p 124-125
(AD-739245; FTD-MT-24-1595-71) Avail: NTIS CSCL 20/12
It is shown that a comparison of the Lorentz number calculated by Predvoditelev's formula (1934) and those obtained by the kinetic equation (E. Puteley, 1960) for a mixed scattering mechanism for Ge and Si shows good agreement. Author (GRA)

N72-27803# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN TECHNICAL POSSIBILITIES OF PHOTOCELLS

BASED ON BETA-SiC
Yu. M. Altaiskii 6 Jan. 1972 12 p refs Transl. into ENGLISH from Vestn. Polytekhn. Inst. Kiev, ser. teploenerg. (USSR), no 6, 1969 p 124-129
(AD-739223; FTD-HT-23-1240-71) Avail: NTIS CSCL 20/12

The report discusses the possible use of beta-silicon carbide as a photocell material due to its outstanding physical properties. Experimental results are presented on preliminary studies. GRA

N72-27804# New York Univ., N.Y. Dept. of Physics.
MAGNETIC BEHAVIOR OF MATERIALS HAVING LARGE LOCALIZED MOMENTS Final Report, 1 Apr. 1970 - 31 Dec. 1971
Peter M. Levy Feb. 1972 9 p refs
(AF Proj. 9764)
(AD-739188; AFOSR-72-0474TR) Avail: NTIS CSCL 20/12

The report reviews research under the contract for the past two years on the behavior of magnetic materials which have large orbital contributions to their magnetic moments. GRA

N72-27805# Air Force Systems Command, Wright-Patterson AFB, Ohio.
THE EFFECT OF IRRADIATION BY GAMMA RAYS ON THE FIRST CONSTANT OF MAGNETIC CRYSTAL-LOGRAPHIC ANISOTROPY OF SINGLE CRYSTALS OF NICKEL AND NICKEL-COPPER FERRITES
N. N. Sirota and A. P. Ges 12 Nov. 1971 10 p ref Transl. into ENGLISH from Dokl. Akad. Navuk (BSSR) (Minsk), v. 11, no. 9, 1967 p 774-776
(AD-739286; FTD-MT-24-122-71) Avail: NTIS CSCL 20/12

An experimental investigation was made of the effect of various dosages of gamma-radiation on the first given anisotropy constant of nickel-copper ferrit single crystals containing 25 and 50 mol. percent of a given composition. The results are summarized in a table for a given radiation dose. Author (GRA)

N72-27806# Texas A&M Univ., College Station. Dept. of Industrial Engineering.
TESTS OF PLASTIC ENCAPSULATED SEMICONDUCTORS M.S. Thesis
Siegfried R. Fick 1971 96 p refs
(AD-739473) Avail: NTIS CSCL 09/1

The paper evaluates test data of plastic encapsulated semiconductors from four manufacturers and three different supply sources tested under high humidity and high temperature in a test chamber in a laboratory and under field conditions in Panama. The complete block design is used to perform the statistical analyses of the test results. Suggestions are given for improving the test herein reported on and also for establishing a proposed test program. Author (GRA)

N72-27807# University of Southern Calif., Los Angeles.
NEW METHODS FOR GROWTH AND CHARACTERIZATION OF GaAs AND MIXED III-V SEMICONDUCTOR CRYSTALS Semiannual Technical Report, 1 Jul. 1971 - 1 Jan. 1972
William R. Wilcox 1 Jan. 1972 50 p refs
(Contracts DAHC15-71-G-6; DAHC15-70-G-14; ARPA Order 1623)
(AD-739374) Avail: NTIS CSCL 20/12

The purpose of the program is to develop new and improved methods for the growth and characterization of gallium arsenide (GaAs) and mixed III-V semiconductor crystals. A new Czochralski technique has been developed. An apparatus for liquid-encapsulated floating-zone melting of III-V crystals has been constructed. The kinetics of drying and moisture absorption by boron oxide encapsulant have been measured and published. Further improvements have been made in the travelling heater growth method. A new method is being developed to lower oxygen concentrations during liquid epitaxial growth of GaAs, so as to permit growth at significantly lower temperatures. The influence of bending and short term heating on mobility and carrier concentration of GaAs has been studied. GRA

N72-27808# Office of Naval Research, London (England).
UMIST, THE SOLID STATE PHYSICS CONFERENCE Conference Report
William J. Condell 14 Feb. 1972 37 p refs Conf. held at Manchester, 4-6 Jan. 1972
(AD-739691; ONRL-C-4-72) Avail: NTIS CSCL 20/12

A digest of selected papers read at the Solid State Physics Conference held at the University of Manchester Institute of Science and Technology, 4-6 January 1972 is given. A complete list of papers presented is included. Author (GRA)

N72-27809# Florida Atlantic Univ., Boca Raton. Dept. of Physics.
RECOMBINATION STUDIES AND RADIATIVE TRANSITIONS IN SEMICONDUCTORS Final Scientific Report, 1 Feb. 1967 - 31 Jan. 1972
John S. Blakemore and Roger A. Messenger Feb. 1972 12 p refs
(Grant AF-AFOSR-1259-67)
(AD-739978; AFOSR-72-0594TR) Avail: NTIS CSCL 20/12

The report is concerned with electron generation and recombination processes in semiconductors. Some work is described with germanium and purified monocrystal tellurium, but emphasis is on roles of deep flaw levels in silicon and gallium arsenide. Photoionization properties, and hole capture as determined from photoconductance, are measured for indium in silicon, and for manganese, cobalt, and nickel in gallium arsenide. Experimental results are correlated with theoretical models for deep flaw states. Author (GRA)

N72-27810# Dayton Univ., Ohio. Dept. of Physics.
RESEARCH ON II-VI COMPOUNDS AT VERY LOW TEMPERATURES Final Report, 1 Aug. 1966 - 1 Aug. 1971
Marshall M. Kreitman Wright-Patterson AFB, Ohio ARL Dec. 1971 179 p refs
(Contract F33615-67-C-1027; AF Proj. 7885)
(AD-739867; ARL-71-0290) Avail: NTIS CSCL 20/12

The contractual work effort is involved with fundamental measurements of optical absorption, reflection, emission, and transmission, thermal conductivity, specific heat, magnetoresistance, nuclear magnetic resonance, and magnetic susceptibility on II-VI compounds and related semiconductors in a pure state and in a doped state over a wide range of temperature, including low temperatures obtainable only by magnetic cooling techniques. Some of the work on the optical and electrical properties was carried out with the aid of ion implantation techniques. Those physical properties which change under radiation damage and which influence ultrasonic mechanical wave interactions in these crystals are also investigated. Author (GRA)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N72-27811# National Research Council of Canada, Ottawa (Ontario). Fuels and Lubricants Lab.
TECHNICAL EVALUATION REPORT ON PROPULSION AND ENERGETICS PANEL 37TH MEETING ON AIRCRAFT FUELS, LUBRICANTS, AND FIRE SAFETY
R. B. Whyte and L. Gardner Paris AGARD May 1972 9 p refs
(AGARD-AR-44) Avail: NTIS HC $3.00

The discussions which took place at a meeting on aircraft fuels, lubricants, and fire safety are presented. The subjects discussed are: (1) fuels production, analysis and testing, (2) fuel handling, (3) lubricants, and (4) fire safety research. It was

concluded that from an operational aspect the fuels and lubricants used for aircraft engines are satisfactory up to at least Mach 2.2. It was recommended that additional developments be undertaken to provide refueling systems capable of dealing with larger volumes of fuel at higher rates of flow than exist in present equipment. Author

N72-27812# Naval Postgraduate School, Monterey, Calif.
STUDIES PERTAINING TO SOLID PROPELLANT FRACTURE
G. H. Lindsey 31 Jan. 1972 76 p refs
(AD-739355; NPS-57LI72011A) Avail: NTIS CSCL 21/9

The study of propellant fracture has been subdivided into three parts: a fracture criterion is developed for stress fields producing mixed mode crack propagation by drawing a comparison with fracture in uncracked geometries; a means for predicting crack growth and velocity has been developed for linear viscoelastic materials strictly on the basis of stress intensity factors. A fracture characterization of critical stress intensity factor for a CTPB propellant has been completed, which facilitates the application of the theory; and, extensive dewetting experiments have been completed which have confirmed prior theoretical developments of a quasielastic dewetting theory.
Author (GRA)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N72-27813 Utah Univ., Salt Lake City.
A HIGH-HEATING-RATE THERMAL ANALYSIS OF SOLID-PROPELLANT REACTIONS Ph.D. Thesis
Larry Sidney Bouck 1971 185 p
Avail: Univ. Microfilms Order No. 72-499

A new, high heating rate, thermoanalytical technique for the study of condensed phase reactions was developed and applied in an investigation of a number of state-of-the-art binder-fuels and ammonium perchlorate based, propellant-like materials. The energy effects produced during the thermal degradation of binder-fuels in nitrogen were quite small at high heating rates. The differential thermograms of some binders indicated endothermic reactions in the temperature range of 500 K to 600 K. A high degree of correlation was found between the thermal decomposition characteristics of binder-fuels and their ignition in oxygen. The energy effect of the ammonium perchlorate phase change at 513 K is clearly displayed. The temperature of the cubic to orthorhombic phase change of ammonium perchlorate during transition cooling could be reduced as much as 80 K at cooling rates of about 50 K/sec.
Dissert. Abstr.

N72-27814* National Aeronautics and Space Administration, Washington, D.C.
ENVIRONMENTAL IMPACT STATEMENT QUIET ENGINE PROGRAM Draft Environmental Impact Statement
Feb. 1971 5 p
(NASA-TM-X-68545) Avail: NASA Public Document Rooms, $1.00 CSCL 21E

The quiet engine program is described, including technology demonstration, noise level determination, and acoustic and aerodynamic data acquisition. Unavoidable adverse environmental effects are reviewed. The relationship between the local short term uses of the environment and the maintenance of long term productivity is also investigated. J.A.M.

N72-27815*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A DESCRIPTION OF THE THRUSTER ATTITUDE CONTROL SIMULATION AND ITS APPLICATION TO THE HEAO-C STUDY
Larry B. Brandon 1 Dec. 1971 48 p refs
(NASA-TM-X-64660) Avail: NTIS HC $4.50 CSCL 21H

During the design and evaluation of a reaction control system (RCS), it is desirable to have a digital computer program simulating vehicle dynamics, disturbance torques, control torques, and RCS logic. The thruster attitude control simulation (TACS) is just such a computer program. The TACS is a relatively sophisticated digital computer program that includes all the major parameters involved in the attitude control of a vehicle using an RCS for control. It includes the effects of gravity gradient torques and HEAO-C aerodynamic torques so that realistic runs can be made in the areas of fuel consumption and engine actuation rates. Also, the program is general enough that any engine configuration and logic scheme can be implemented in a reasonable amount of time. The results of the application of the TACS in the HEAO-C study are included. Author

N72-27816*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIENCE WITH LOW COST JET ENGINES
Robert L. Cummings 1972 20 p Presented at Natl. Business Aircraft Meeting, Wichita, Kansas, 15-17 Mar. 1972; sponsored by Soc. of Automotive Engr.
(NASA-TM-X-68085; E-6985) Avail: NTIS HC $3.00 CSCL 21E

A summary is given of the results of a NASA program for reducing the cost of turbojet and turbofan engines. The design, construction, and testing of a simple turbojet, designed for use in missiles, is described. Low cost axial stage fabrication, the design of a fan jet engine suitable for propulsion of light aircraft, and application of such engines to provide higher flight speeds, are discussed. Author

N72-27817*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PREDICTED UPWASH ANGLES AT ENGINE INLETS FOR STOL AIRCRAFT
James A. Albers Washington Jul. 1972 16 p refs
(NASA-TM-X-2593; E-6901) Avail: NTIS HC $3.00 CSCL 20D

Upwash angles were predicted for a STOL lifting system by using a two-dimensional potential flow analysis. Upwash angles are presented for distances ahead of the wing leading edge of 50, 75, and 100 percent of wing chord. The upwash angle was determined to be insenitive to the vertical location of the engine inlet. For a wide range of takeoff and landing conditions, the upwash angle was found to be a function of the total two-dimensional lift coefficient. Upwash angles, along with typical flow fields, are presented for a range of total two-dimensional lift coefficients from 2 to 12. Three-dimensional effects were considered in estimating upwash angles for an unswept-wing externally blown flap aircraft. For this STOL configuration, effective upwash angles during takeoff, approach, and waveoff conditions were found to be 22 deg, 26 deg, and 36 deg, respectively. Author

N72-27818*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
EVALUATION OF RANGE AND DISTORTION TOLERANCE FOR HIGH MACH NUMBER TRANSONIC FAN STAGES. TASK 2: PERFORMANCE OF A 1500-FOOT-PER-SECOND TIP SPEED TRANSONIC FAN STAGE WITH VARIABLE GEOMETRY INLET GUIDE VANES AND STATOR Final Report
K. R. Bilwakesh, C. C. Koch, and D. C. Prince Jun. 1972 224 p refs
(Contract NAS3-11157)
(NASA-CR-72880; R71AEG195) Avail: NTIS HC $13.25

CSCL 21E

A 0.5 hub/tip radius ratio compressor stage consisting of a 1500 ft/sec tip speed rotor, a variable camber inlet guide vane and a variable stagger stator was designed and tested with undistorted inlet flow, flow with tip radial distortion, and flow with 90 degrees, one-per-rev, circumferential distortion. At the design speed and design IGV and stator setting the design stage pressure ratio was achieved at a weight within 1% of the design flow. Analytical results on rotor tip shock structure, deviation angle and part-span shroud losses at different operating conditions are presented. The variable geometry blading enabled efficient operation with adequate stall margin at the design condition and at 70% speed. Closing the inlet guide vanes to 40 degrees changed the speed-versus-weight flow relationship along the stall line and thus provided the flexibility of operation at off-design conditions. Inlet flow distortion caused considerable losses in peak efficiency, efficiency on a constant throttle line through design pressure ratio at design speed, stall pressure ratio, and stall margin at the 0 degrees IGV setting and high rotative speeds. The use of the 40 degrees inlet guide vane setting enabled partial recovery of the stall margin over the standard constant throttle line. Author

N72-27819*# Bendix Corp., Madison Heights, Mich.
OXIDATION RESISTANT POROUS MATERIAL FOR TRANSPIRATION COOLED VANES
Per Madsen and Robert M. Rusnak Washington NASA May 1972 102 p refs
(Contract NAS3-10477)
(NASA-CR-1999) Avail: NTIS HC $3.00 CSCL 21E

Porous metal sheet with controlled permeability was made by space winding and diffusion bonding fine wire. Two iron-chromium-aluminum alloys and three chromium alloys were used: GE 1541 (Fe-Cr-Al-Y), H 875 (Fe-Cr-Al-Si), TD Ni Cr, DH 245 (Ni-Cr-Al-Si) and DH 242 (Ni-Cr-Si-Cb). GE 1541 and H 875 were shown in initial tests to have greater oxidation resistance than the other candidate alloys and were therefore tested more extensively. These two materials were cyclic furnace oxidation tested in air at 1800 and 2000 F for accumulated exposure times of 4, 16, 64, 100, 200, 300, 400, 500, and and 600 hours. Oxidation weight gain, permeability change and mechanical properties were determined after exposure. Metallographic examination was performed to determine effects of exposure on the porous metal and electron beam weld joints of porous sheet to IN 100 strut material. Hundred hour stress rupture life and tensile tests were performed at 1800 F. Both alloys had excellent oxidation resistance and retention of mechanical properties and appear suitable for use as transpiration cooling materials in high temperature gas turbine engines.
Author

N72-27820*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VARIABLY POSITIONED GUIDE VANES FOR AERODYNAMIC CHOKING Patent Application
David Chestnutt, inventor (to NASA) Filed 27 Jun. 1972 13 p
(NASA-Case-LAR-10642-1; US-Patent-Appl-SN-266820) Avail: NTIS HC $3.00 CSCL 21E

Turbine inlet guide vanes which may be variable positioned to provide aerodynamic choking are described. The choked condition is obtained by pivoting selected guide vanes about their own axes. The invention provides a means of obtaining aerodynamic choking without encountering the losses caused by other choking devices. NASA

N72-27821*# United Technology Center, Sunnyvale, Calif.
STUDY OF SOLID ROCKET MOTORS FOR A SPACE SHUTTLE BOOSTER, VOLUME 2 Final Report
19 Apr. 1972 23 p Sponsored by NASA
(NASA-CR-127416; UTC-4205-72-7-Vol-2-Add-1) Avail: NTIS HC $3.25 CSCL 21H

Additional technical data have been prepared to supplement the data supplied in the SRM shuttle booster final report. These data cover performance characteristics utilizing motor efficiencies of 0.960 and 0.947 with nozzle divergence half angles of 15 deg and 20 deg, respectively; PBAN propellant characteristics; parametric data to extend baseline designs to varying states of SRM's; summary of SRM mass properties; and SRM exhaust plume profiles. G.G.

N72-27822# National Aerospace Lab., Tokyo (Japan).
AN INVESTIGATION OF A HIGH SPEED AXIAL-FLOW TURBINE. 2: A SINGLE STAGE TURBINE
Tadao Torisaki, Mitsuo Morita, Hiroyuki Nouse, Shizuo Sekine, and Shigeo Inoue Feb. 1972 24 p refs In JAPANESE; ENGLISH summary
(NAL-TR-273) Avail: NTIS HC $3.25

The results of cold air tests of a single stage, axial-flow turbine are reported. A conventional profile, T-6, was used both for nozzle and rotor blade profiles. The tests were carried out over the expansion ratio based on turbine inlet and outlet total pressure ranging from 1.1 to 2.0 and the rotor blade-speed parameter ranging from 30 percent to 110 percent of the design value. Relatively high overall performance was achieved over the range of the blade to gas speed ratio from 0.4 to 0.5. Spanwise distribution of the expansion ratio, the stage enthalpy drop and the adiabatic efficiency were made clear from the turbine inlet, the nozzle exit and the rotor blade exit surveys. These results are compared with the previous test results obtained from the annular nozzle cascade test, and the effects of the rotor blade row on the upstream flow coming through the nozzle blade row are discussed. The result of an off-design overall performance calculation is also presented. Author

N72-27823# National Aerospace Lab., Tokyo (Japan).
AN INVESTIGATION OF A TRANSONIC AXIAL-FLOW TURBINE. 1: A COLD AIR TEST OF THE ANNULAR TURBINE NOZZLE CASCADE
Tadao Torisaki, Hiroyuki Nouse, Mitsuo Morita, Shigeo Noue, and Shizuo Sekine Feb. 1972 16 p refs In JAPANESE; ENGLISH summary
(NAL-TR-272) Avail: NTIS HC $3.00

A cold air test of an annular nozzle cascade for a transonic axial-flow turbine was made in a cascade exit flow Mach number ranging from 0.2 to 1.2. The tip diameter, the hub diameter, the maximum blade thickness ratio at the mean and the trailing edge thickness are 512.9 mm, 355.0 mm, 12.4% and 0.2 mm respectively, and the nozzle exit flow Mach number at the design point is 1.322 at the nozzle hub. In order to prevent the flow from separation which may occur in adverse pressure regions on the blade surface, a low diffusion parameter blade was designed and used for the cascade. Comparing this with the previous test results of an annular turbine nozzle cascade using a T-6 profile, a great improvement was seen in aerodynamic characteristics. The test result showed good agreement with the results of a two-dimensional cascade test. Author

N72-27824*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTIMIZATION OF ELECTROSTATIC DUAL-GRID BEAM-DEFLECTION SYSTEM
W. R. Hudson, W. C. Lathem, J. L. Power, and B. A. Banks Jun. 1972 22 p refs
(NASA-TM-X-68096; E-7012) Avail: NTIS HC $3.25 CSCL 21C

Tests were performed to minimize accelerator grid erosion of a 5-cm diameter Kaufman ion thruster due to direct beam impingement. Several different screen hole diameters, pillow-shape-square screen holes, and dished screen grids were tried. The optimization was accomplished by copper plating the accelerator grid before testing each grid configuration on a thruster for a 2-hour run. The thruster beam sputtered copper and molybdenum from the accelerator grid where the beam impinged. The observed erosion patterns and measured accelerator currents were used to determine how to modify the accelerator system. The lowest erosion was obtained for a 50-percent open

area pillow-shape-square-aperture screen grid, dished 0.043 centimeter convex toward the accelerator grid, which was positioned with the center of the screen grid 0.084 centimeter from the accelerator grid. During this investigation the accelerator current was reduced from 120 to 55 microamperes and was also more uniformly distributed over the area of the accelerator grid. Author

N72-27825*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FIVE-CENTIMETER DIAMETER ION THRUSTER DEVELOPMENT Program Summary, June 1972
A. J. Weigand Jul. 1972 28 p refs
(NASA-TM-X-68110; E-7048) Avail: NTIS HC $3.50 CSCL 21C

All system components were tested for endurance and steady state and cyclic operation. The following results were obtained: acceleration system (electrostatic type), 3100 hours continuous running; acceleration system (translation type), 2026 hours continuous running; cathode-isolator-vaporizer assembly, 5000 hours continuous operation and 190 restart cycles with 1750 hours operation; mercury expulsion system, 5000 hours continuous running; and neutralizer, 5100 hours continuous operation. The results of component optimization studies such as neutralizer position, neutralizer keeper hole, and screen grid geometry are included. Extensive mapping of the magnet field within and immediately outside the thruster are shown. A technique of electroplating the molybdenum accelerator grid with copper to study erosion patterns is described. Results of tests being conducted to more fully understand the operation of the hollow cathode are also given. This type of 5-cm thruster will be space tested on the Communication Technology Satellite in 1975. Author

N72-27826# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Elektrische Antriebe.
APPLICATION OF ELECTROSTATIC ION THRUSTERS FOR INTERPLANETARY MISSIONS (Ph.D. Thesis - Brunswick Univ.) [ANWENDUNG ELEKTROSTATISCHER IONEN-TRIEBWERKE FUER INTERPLANETARE MISSIONEN]
Guenther F. Au Feb. 1972 91 p refs In GERMAN; ENGLISH summary
(DLR-FB-72-18) Avail: NTIS HC $6.75; DFVLR, Porz 23 DM

The feasibility of interplanetary missions using electrostatic ion thrusters and nuclear power supplies is investigated for missions to the planets Venus, Mercury, Mars, and Jupiter. The calculations are presented in two steps; firstly, an earth orbit of 500 km, and secondly, interplanetary transfers with constant, tangential and azimuth thrust. The results are compared with results for chemical and nuclear propulsion systems. The results show that for transfers from a 500 km orbit with electric propulsion the burnout and payload masses, respectively, are higher than with chemical and nuclear propulsion. With chemical and nuclear propulsion the flight times to the planets Venus, Mercury, and Mars, are shorter than with electric propulsion. On the other hand for Jupiter swingby, flight times can be shorter than for chemical and nuclear propulsion. ESRO

N72-27827# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
THE TIME OF FLIGHT SPECTROMETER DATA REDUCTION TECHNIQUES Technical Report, Sep. 1970 - Feb. 1971
David H. Fritts Dec. 1971 23 p refs
(AF Proj. 3141)
(AD-739189; AFAPL-TR-71-65) Avail: NTIS CSCL 21/8

The time-of-flight spectrometer (TOFS) technique has proven to be a very useful tool for investigating monoenergetic charged particle beams. In particular, it has been the singularly most important diagnostic measurement used for determining the performance of colloidal electric propulsion thrusters (1, 3). The analysis presented here points out how significant errors, greater than 10%, in the particle mass flux may be commonplace in currently used data reduction techniques. An alternative data reduction approach is suggested. The time-of-flight data presented in the literature typically represents the best data obtained in the particular experiment. In this paper some of the data that has anomolies present is examined to see what information can be gleaned. For example in the generation of a positively charged colloidal beam an electrical discharge will occasionally occur at the source. This discharge will frequently be invisible to the eye but is quite apparent on the T.O.F. trace. This problem is analyzed. Secondary charged particle effects on the TOF trace are also discussed. Author (GRA)

N72-27828# ARO, Inc., Arnold Air Force Station, Tenn.
EVALUATION OF THE THIOKOL TE-T-607-1 MOTOR AT SIMULATED ALTITUDE CONDITIONS Final Report
A. A. Cimino AEDC Mar. 1972 34 p refs
(Contract F40600-72-C-0003; ARO Proj. RC1261)
(AD-739191; AEDC-TR-72-13) Avail: NTIS CSCL 21/8

A Thiokol TE-T-607-1 solid-propellant rocket motor was successfully fired at an average simulated altitude of 98,000 ft. The program objectives were to determine vacuum ballistic performance after temperature conditioning at 70 F, to determine altitude ignition characteristics, to evaluate motor structural integrity, and to determine motor temperature-time history at selected critical locations during and after motor operation. Author (GRA)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation, and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N72-27829 California Inst. of Tech., Pasadena.
PROPAGATION OF 1-10 MeV SOLAR FLARE PROTONS IN INTERPLANETARY SPACE Ph.D. Thesis
Stephen S. Murray 1971 227 p
Avail: Univ. Microfilms Order No. 72-479

Observations of 1 to 10 MeV solar flare protons associated with the 7 June 1969 solar event were used in an investigation of the physical processes affecting particle propagation in interplanetary space. The observations were made with the solar and galactic cosmic ray experiment on board to the OGO-F, a low altitude polar-orbiting satellite. It was found during the decay of the event that the processes of diffusion, convection, and energy change must be considered to obtain satisfactory agreement between the observations and theoretical predictions. For this event, there is clear evidence for energy change processes occurring in interplanetary space. The observed energy change is not simply due to adiabatic deceleration in a uniformly expanding solar wind. During the decay the effects of diffusion are consistent with an energy-independent diffusion coefficient from 1 to 10 MeV. Dissert. Abstr.

N72-27830 National Lending Library for Science and Technology, Boston Spa (England).
SOLAR CONSTANT AND CLIMATE OF THE EARTH
V. F. Loginov and B. I. Sazonov [1972] 11 p refs Transl. into ENGLISH from Izv. Vses. Geog. Obs. (USSR), no. 103, 1971 p 229-233 No diagrams etc.; to be used in conjunction with original book
(NLL-M-22455-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The nonlinearity of the relationship between the solar constant and the ratio of the areas of the spots and faculae on the sun's photosphere is demonstrated. This nonlinearity has important climatic consequences and explains the appearance of two waves in the climatic indices within the main cycles of solar activity. The causes of large scale planetary fluctuations of

climate, for the development of which, apparently, small changes in the solar constant are necessary, are discussed. Author

N72-27831*# Wisconsin Univ., Madison. Dept. of Physics.
SOLAR WIND PHYSICS Semiannual Status Report
Jun. 1972 60 p refs
(Grant NGR-50-002-162)
(NASA-CR-127274) Avail: NTIS HC $5.00 CSCL 03B

A double-chambered gas proportional counter was constructed to detect and identify solar wind ions after acceleration by a high voltage power supply. It was determined that the best method of detecting deuterium in the solar wind is to use a tritium target as proposed for IMP H and J. The feasibility of detecting H(+) and He(+) ions of interstellar origin is considered. A program is described to carry out ground-based astronomical observations of faint, diffuse optical emission lines from interstellar gas. Hydrogen and oxygen emission lines from galactic sources were detected and the galactic and geocoronal H alpha and beta lines were clearly resolved. K.P.D.

N72-27832*# Scientific Translation Service, Santa Barbara, Calif.
COLLECTIVE INTERACTIONS OF HEAVY NUCLEI NUCLEONS AND HIGH-ENERGY COSMIC RAYS
N. L. Grigorov, D. A. Znuravlev, V. D. Kozlov, M. A. Kondratyeva, I. D. Rapoport, and I. A. Savenko Washington NASA May 1972 5 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 202, no. 1, 1972 p 65-66
(Contract NASw-2035)
(NASA-TT-F-14409) Avail: NTIS HC $3.00 CSCL 03B

The efficiency of generating pions of a given energy interacting with a free nucleus and with one bound in a nucleus of nucleons is compared. Author

N72-27833*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MEASUREMENTS OF THE Fe-GROUP ABUNDANCE IN ENERGETIC SOLAR PARTICLES
D. L. Bertsch, C. E. Fichtel, C. J. Pellerin, and D. V. Reames Jun. 1972 17 p refs Submitted for publication
(NASA-TM-X-65919; X-662-72-197) Avail: NTIS HC $3.00 CSCL 03B

The abundance of Fe-group nuclei in the energetic solar particles was measured twice in the 24 January 1971 event and once in the 2 September 1971 event. Including earlier results from the 2 September 1966 event, the Fe-group abundance was found to be in the range from 3% to 6% of the oxygen nuclei in the energy interval from 21 to 50 MeV/nucleon, in those events where the Fe-group abundance could be measured. Fe-nuclei have a different charge-to-mass ratio from that of the C, N, O nuclei, so small variations in the Fe abundance in solar particles are expected. In the three exposures where the statistics were adequate to construct an energy spectrum, the Fe-group nuclei were seen to have an energy/nucleon spectrum similar to that of the C, N, O nuclei; however, the energy/nucleon range was limited. The abundance for the Fe-group nuclei is consistent with the present solar spectroscopic abundance estimates. Author

N72-27834*# Stanford Univ., Calif. Inst. for Plasma Research.
WHY DOES THE SUN SOMETIMES LOOK LIKE A MAGNETIC MONOPOLE? Interim Scientific Report
John M. Wilcox May 1972 16 p refs
(Grant NGR-05-020-559; Contract N00014-67-A-0112-0068; Grant NSF GA-31138; NR Proj. 323-003)
(NASA-CR-127423; SU-IPR-469) Avail: NTIS HC $3.00 CSCL 03B

For several months in early 1965 the sun appeared to have large scale magnetic field directed outwards at nearly all latitudes and longitudes. Several independent observations that lead to this puzzling situation are discussed. Author

N72-27835*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
ANISOTROPIES IN THE INTERPLANETARY INTENSITY OF SOLAR PROTONS E SUB p > 0.3 MeV
William G. Innanen and James A. VanAllen Jun. 1972 69 p refs
(Contracts NAS5-9076; N00014-68-A-0196-0003)
(NASA-CR-127425; U-of-Iowa-72-15) Avail: NTIS HC $5.50 CSCL 03B

From the data on solar protons with energy > 0.3 MeV obtained by Explorer 35 since July 1967, ten events were selected for the study of intensity vs time and of angular distributions of intensity in interplanetary space near the earth. The bases of selection were that the events be of adequate intensity for statistically satisfactory study and that they be attributable to a single solar flare so that their time histories were not complicated by overlapping emissions of particles. The principal findings for these events are presented. Author

N72-27836# Scientific Group for Space Research, Athens (Greece).
DATA OF SOLAR TERRESTRIAL INTEREST, AUGUST 1971
D. J. Ilias, ed. and D. P. Elias, ed. Aug. 1971 15 p
Avail: NTIS HC $3.00

Routine observations of solar-terrestrial interest, collected at the following stations of the Scientific Group for Space Research are presented for August 1971: (1) Agia Paraskevi ionospheric station temporarly housed at the Democritus Nuclear Research Center, near Athens, (2) Icaros Athens optical tracking station (satellites and visual observations of sunspots), and (3) Dedalos Larissa optical tracking station (satellites). Author

N72-27837# Scientific Group for Space Research, Athens (Greece).
DATA OF SOLAR TERRESTRIAL INTEREST, JULY 1971
D. J. Ilias, ed. and D. P. Elias, ed. Jul. 1971 22 p
Avail: NTIS HC $3.25

Routine observations of solar-terrestrial interest, collected at the following stations of the Scientific Group for Space Research are presented for July 1971: (1) Agia Paraskevi ionospheric station temporarly housed at the Democritus Nuclear Research Center, near Athens, (2) Icaros Athens optical tracking station (satellites and visual observations of sunspots), and (3) Dedalos Larissa optical tracking station (satellites). Author

N72-27838# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
ENERGY DEPENDENCE OF THE ANISOTROPY FOR COSMIC RAY ELECTRONS
W. Fischbein Jul. 1972 21 p refs
(RM-548) Avail: NTIS HC $3.25

The existence of a spatial anisotropy for the electron component of cosmic rays is considered for the energy range of 100 to 1000 GeV. It is found that an anisotropy as large as 1 percent is likely to be seen at energies as low as 100 GeV. Expressions are derived for the energy dependence of the anisotropy based on a model in which local pulsars are the predominant electon sources. Supernovae radio remnants are considered as possible additional sources. Author

N72-27839# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE QUESTION OF SOLAR-CYCLE VARIATIONS IN EXCESS RADIATION INTENSITY AT LOW ALTITUDES
V. S. Tsaplin [1972] 1 p refs Transl. into ENGLISH from Kosm. Issed. (Moscow), v. 10, no. 2, 1972 p 301-302
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Cosmos satellite excess radiation intensity measurements at high latitudes diminished 2.5-fold at the end of the measurement period as compared with the beginning. Results verify the assumption of a direct relationship between excess radiation and galactic cosmic rays. G.G.

N72-27840# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
SOLAR MICROWAVE BURSTS AS INDICATORS OF THE OCCURRENCE OF SOLAR PROTON EMISSION
D. L. Croom 11 Jan. 1971 24 p refs
(AF Proj. 4643)
(AD-738287; AFCRL-71-0558) Avail: NTIS CSCL 03/2

A study was made of the relation of 19 GHz (approx. = 1.58 cm) solar radio bursts to solar proton emission, with particular reference to the usefulness of relatively long duration bursts with intensities exceeding 50% of the quiet sun flux as indicators of the occurrence of proton events during the four years from 1966 to 1969. From 76 to 88% of such bursts are directly associated with solar protons and 60 to 85% of the moderate to large proton events in the four-year period could have been predicted from these bursts. The complete microwave spectra of the proton events were also studied and used to extend the results obtained at 19 GHz to other frequencies, particularly in the 5 to 20 GHz band. The widely used frequency of 2.8 GHz is not the optimum frequency for this purpose since proton events have a minimum of emission in this region. Most of the radio energy of proton events is at frequencies above 10 GHz. The radio spectra of proton events tend to peak at higher frequencies than most nonproton events, the overall range being 5 to 70 GHz, with a median of 10 to 12 GHz and a mean of 2+ GHz. Author (GRA)

N72-27455 Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France).
DEGRADATION OF OPTICAL MATERIALS IN SPACE ENVIRONMENTS. MECHANISM OF DEFECT GENERATION [DEGRADATION DES MATERIAUX OPTIQUES EN ENVIRONNEMENT SPATIAL. MECANISMES DE CREATION DE DEFAUTS]
M. Romero *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 243-247 In FRENCH (For availability see N72-27435 18-14)

N72-27456 Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France).
DEGRADATION OF OPTICAL SYSTEMS IN HIGH ENERGY SPACE ENVIRONMENTS [DEGRADATION DES SYSTEMES OPTIQUES EN ENVIRONMENT SPATIAL ENERGETIQUE]
J. Bourrieau *In* CNES Proc. of the 3rd Conf. on Space Optics 1971 p 249-264 refs In FRENCH (For availability see N72-27435 18-14)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N72-27841 California Inst. of Tech., Pasadena.
NONSPHERICAL PERTURBATIONS OF RELATIVISTIC GRAVITATIONAL COLLAPSE Ph.D. Thesis
Richard Henry Price 1971 141 p
Avail: Univ. Microfilms Order No. 72-482

The results of computations in comoving coordinates are presented to show that the scalar field in a collapsing star neither disappears nor halts the collapse, as the star passes inside its gravitational radius. On the star's surface, near the event horizon, the scalar field varies due to time dilation. The dynamics of the field outside the star can be analyzed with a simple wave equation containing a spacetime curvature induced potential. The analysis of scalar-field perturbations works as well for electromagnetic and gravitational perturbations and also for zero rest mass perturbation fields of arbitrary integer spin. All these perturbation fields obey wave equations with curvature potentials that differ little from one field to another. Dissert. Abstr.

N72-27842 California Inst. of Tech., Pasadena.
WHITE DWARFS: A DISSERTATION IN ASTRONOMY Ph.D. Thesis
Henry Longfellow Shipman 1971 162 p
Avail: Univ. Microfilms Order No. 72-487

Model atmosphere techniques and intermediate band photoelectric scans were used to determine the properties of white dwarfs. Atmospheres were calculated for models with 6000 < or = effective T < or = 50,000 for solar composition and 6000 < or = effective T < or = 22,000 for helium-rich (Y = 1) models. Photoelectric scans of 37 white dwarfs were used as an observational basis. Dissert. Abstr.

N72-27843 California Univ., Los Angeles.
THE SOLAR ABUNDANCE OF IRON Ph.D. Thesis
John Ernest Ralph Ross 1971 252 p
Avail: Univ. Microfilms Order No. 72-1503

The damping constant was studied from theoretical point and empirical viewpoints. Both studies indicate that the simple formula for the damping constant usually employed by astrophysicists, and in this analysis, underestimates the true damping constant under conditions found in the solar photosphere. Hence, it is expected that the lowest abundance of iron derived from saturated lines should constitute an upper bound to the solar abundance of iron. An attempt was made to extract reliable f-values for weak lines, lines which are unaffected by the value of the damping constant, by combining relative f-value data, which are available for lines having a wide range in intensity (or strength), with the well-determined strongline absolute f-value data. A value is suggested for the solar photospheric abundance of iron, where the uncertainty is due to an uncertainty in choice of analysis. Dissert. Abstr.

N72-27844 Rensselaer Polytechnic Inst., Troy, N.Y.
ON-LINE TRACKING OF A THRUST MANEUVERING SPACE VEHICLE Ph.D. Thesis
Kay Yong 1971 121 p
Avail: Univ. Microfilms Order No. 72-1217

The problem of tracking a thrust-maneuvering space vehicle based on noise measurement quantities from the ground radar station was examined. A technique was developed for estimating on-line orbital states especially after an arbitrary thrust maneuvering of the vehicle. A rapid estimation scheme was derived from a quadratic cost functional which minimizes the difference of the measurement errors and yields a maximum likelihood estimate of the state. A measurable covariance matrix was introduced which depends upon measurement quantities containing information of the unknown thrusting input. The more general problem of tracking the orbital states in a three-dimensional space was also examined. Dissert. Abstr.

N72-27845 Purdue Univ., Lafayette, Ind.
PLANETARY GRAVITATIONAL FIELDS FROM ORBITAL PHOTOGRAMMETRY Ph.D. Thesis
Robert Wayne Ballew 1971 210 p
Avail: Univ. Microfilms Order No. 72-1826

An analysis of orbital theory, including a discussion of properties of the gravitational potential function as related to an extension of photogrammetric theory to accommodate a solution for planetary gravitational fields, is presented. Basic theories from orbital mechanics and analytical photogrammetry are combined and extended to develop a mathematical model for recovery of gravitational parameters of planetary bodies using multimission orbital and photogrammetric data. A general discussion of parameters involved in mission planning, as well as a preliminary simulation and testing of developed theories, is included. Dissert. Abstr.

N72-27846*# Martin Marietta Corp., Denver, Colo.
DEVELOPMENT OF AN X-RAY SURFACE ANALYZER FOR PLANETARY EXPLORATION Final Report
Benton C. Clark Apr. 1972 113 p refs
(Contract NASw-2248)
(NASA-CR-127526; MCR-72-108) Avail: NTIS HC $7.75 CSCL 03B

An ultraminiature X-ray fluorescence spectrometer was developed which can obtain data on element composition not provided by present spacecraft instrumentation. The apparatus employs two radioisotope sources (Fe-55 and Cd-109) which irradiate adjacent areas on a soil sample. Fluorescent X-rays emitted by the sample are detected by four thin-window proportional counters. Using pulse-height discrimination, the energy spectra are determined. Virtually all elements above sodium in the periodic table are detected if present at sufficient levels. Minimum detection limits range from 30 ppm to several percent, depending upon the element and the matrix. For most elements, they are below 0.5 percent. Accuracies likewise depend upon the matrix, but are generally better than plus or minus 0.5 percent for all elements of atomic number greater than 14. Elements below sodium are also detected, but as a single group. Author

N72-27847*# Chicago Univ., Ill. Lab. for Astrophysics and Space Research
ADVANCED TECHNICAL DEVELOPMENTS IN SUPPORT OF SCIENTIFIC EXPERIMENTS IN SPACE Final Technical Report
James E. Lamport 27 Mar. 1972 9 p
(Grant NGR-14-001-103)
(NASA-CR-127267) Avail: NTIS HC $3.00 CSCL 05A

A technique was developed for preparing solid state, lithium-drifted silicon detectors. Hollow cylindrical detectors were built and tested for possible use as anticoincidence shields to replace conventional plastic scintillators and photomultipliers. A fission cell was developed for the Pioneer F/G instruments and the IMP I subsystem. An electron current detector was developed for Jovian belt measurements of electron flux. A number of circuits and semiconductor devices was also developed. K.P.D.

N72-27848*# Texas Univ., Austin. Electrical Engineering Research Lab.
THE LINEAR POLARIZATION OF LUNAR THERMAL EMISSION AT 3.1 mm WAVELENGTH
Terry L. White and John R. Cogdell 15 Apr. 1972 103 p refs
(Grant NGL-44-012-006)
(NASA-CR-127273; NGL-006-72-2) Avail: NTIS HC $7.25 CSCL 03B

Several observations of the distribution of linearly polarized lunar thermal emission were made at a wavelength of 3.1 mm with 4.88 m parabolic reflector from February to March 1971. A shadow corrected rough surface thermal emission model was least squares fitted to the data. Results indicate an effective lunar dielectric constant of 1.34 + or -.08 with surface roughness characterized by a standard deviation of surface slopes of 18 deg + or - 2 deg. A comparison of these results with previously published values at other wavelengths suggests that the effective lunar dielectric constant decreases with decreasing wavelength. Author

N72-27849*# Minnesota Univ., Minneapolis.
PROPER MOTION SURVEY WITH THE 48-INCH SCHMIDT TELESCOPE. 30: PROPER MOTIONS FOR 1357 FAINT STARS
Willem J. Luyten 15 Mar. 1972 29 p
(Contract NSR-24-005-062)
(NASA-CR-127264) Avail: NTIS HC $3.50 CSCL 03A

A catalog of the proper motion of the faint stars and associated data is presented. Author

N72-27850*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROCEEDINGS OF THE JUPITER RADIATION BELT WORKSHOP
Andrew J. Beck, Jr., ed. 1 Jul. 1972 553 p refs Workshop held at Pasadena, Calif., 13-15 Jul. 1971
(Contract NAS7-100)
(NASA-CR-127124; JPL-TM-33-543) Avail: NTIS HC $29.75 CSCL 22A

Conference papers are presented on Jupiter's radiation belt models, effects of the radiation, energetic electron and proton fluxes, earth-based observations of the Jupiter magnetosphere, spacecraft design considerations, and Pioneer F and G experiments. For individual titles, see N72-27851 through N72-27875.

N72-27851* Colorado Univ., Boulder.
A MODEL FOR JUPITER'S PROTON RADIATION BELT
James Warwick *In* JPL Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 3-24 refs (For availability see N72-27850 18-30)
CSCL 03B

A model for electron and proton energy and density in Jupiter's radiation belt is proposed. It is assumed that electrons diffuse inward from the solar wind. The Davis and Chang diffusion model, in which there is a very steep L-shell dependence in density and energy, is scaled outwards from the peak of the belts at about 1.5 to 2 Jupiter radii to the magnetopause as defined by the magnetic moment. The energetic electron density is calculated to be one billionth of the density in the solar wind, and that is assumed to be the trapping ratio of Jupiter's synchrotron belts. It is further assumed that the same figures apply to protons. The flux density at 80 MHz was measured by the Culgoora ring to be identical to that at 3000 MHz, implying a constant flux density of the synchrotron source of over 20 or 30 to 1 in frequency. It is suggested that the synchrotron spectrum is flat over more than an order of magnitude of frequency. Jupiter is an enormous synchrotron source and has a strong magnetic field, causing long diffusion times for electrons in the magnetosphere. N.E.N.

N72-27852* North American Rockwell Corp., Downey, Calif.
CALCULATED LIMITS FOR PARTICLE FLUXES IN JUPITER'S VAN ALLEN BELTS
James Haffner *In* JPL Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 25-46 ref (For availability see N72-27850 18-30)
CSCL 03B

Electron and proton fluxes in Jupiter's radiation belts are calculated, along with the envelopes of dose rates. The following assumptions are made: the particles in the Jupiter belts are influenced only by the magnetic field of the planet; the particles act correspondingly to the particles in the Earth's belts and the Earth's belts can be used as a model; the magnetic field of Jupiter is essentially a dipole; the radiation of a decimetric nature received from Jupiter is synchrotron radiation due to the electrons, and to a first approximation it is emitted isotropically; and the strength of the emission in the decimetric wavelength range gives an upper bound considering how strong the field can be and how many electrons there are. The point dose rates for tissue and 0.1 gram/cm aluminum shielding at about 3 Jupiter radii are 10000 rads/hr for electrons and 1000 rads/hr for protons. N.E.N.

N72-27853* Iowa Univ., Iowa City.
EQUATORIAL ELECTRON ENERGY AND NUMBER DENSITIES IN THE JOVIAN MAGNETOSPHERE
Joe L. Luthey *In* JPL Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 47-81 refs (For availability see N72-27850 18-30)
(Contract NAS2-5603; Grants NSF GA-1592; NSF GA-14029)
CSCL 03B

A synchrotron model with a Maxwellian energy distribution

of the form e to the (-E/E sub 0) power is used in a comparison with spatially resolved radio interferometric measurements of the Jovian emission. The observations of the decimeter radiation as a function of equatorial distance at 10.4 and 21 cm wavelength were reduced to source emission/cc of source electrons in each of 16 concentric rings. The peak energies for isotropically distributed electrons exceeded the maximum energy for flat orbiting electrons, and the peaks were generally located from 2.25 to 3 Jupiter radii. Beyond 3 radii, the order of magnitude on number density became a sensitive function of pitch angle distribution. The total equatorial intensities at 75 cm wavelength were computed for (E sub 0)(r) and n(r) at different values of B sub 0. The radiative half life for electrons of initial energy E sub 0 in a dipole field was calculated and found to be nearly constant at one year or less for altitudes at and below the position in peak energy. Author

N72-27854* IIT Research Inst., Chicago, Ill.
ELECTRON AND PROTON FLUX MODELS FOR JUPITER'S RADIATION BELTS
David A. Klopp *In* JPL Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 83-108 refs (For availability see N72-27850 18-30)
CSCL 03B

Estimates of the energetic particle distribution in Jupiter's radiation belts are presented and are compared with previous estimates. Mathematical expressions are developed for the equatorial electron and proton fluxes, shielded electron and proton dose rates, and radiation lifetimes of electronic circuits. It is calculated that a 1 g/sq cm aluminum shield will screen out all protons of energy less than 27.5 MeV, and a 2 g/sq cm shield will screen out protons less than 40.6 MeV. The radiation lifetimes are based on a maximum permissible dose value of 10 million rads, a value 1/2 to 1/3 of the flux at which electronic circuits begin to fail. Estimated increases in lifetimes by using a 3 x 50 orbit instead of a 3 x 3 orbit, and going from 1 to 2 g/sq cm are given. N.E.N.

N72-27855* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SCIENTIFIC AND ENGINEERING ANALYSES OF JUPITER'S ENERGETIC ELECTRONS AND PROTONS
Neil Divine *In its* Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 109-127 refs (For availability see N72-27850 18-30)
(Contract NAS7-100)
CSCL 03B

Details of magnetic field conclusions, UHF radio data sets, and the theoretical synchrotron radiation descriptions are summarized for several published and unpublished analyses. The relatively compact set of electron models inspires some confidence in their validity, particularly as they have been derived from numerous data and analysis techniques. Although the models have serious consequences for spacecraft design, the problems they imply are probably soluble with technologies anticipated for spacecraft to be designed for Jupiter encounter. By contrast, the proton models are very diverse, fluxes and energies spanning several orders of magnitude even for those models based on physical considerations; this results from the absence of applicable data. However, even in the midrange of these models, the proton energies and fluxes would be severely hazardous to several spacecraft subsystems. It is therefore desirable to apply further technical consideration to the modeling of Jupiter's energetic proton population. Author

N72-27856* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PREVIOUS DESIGN RESTRAINTS AND RADIATION DAMAGE EFFECTS OF LOW ENERGY PARTICLES **c24**
James H. Trainor *In* JPL Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 129-142 refs (For availability see N72-27850 18-30)
CSCL 20H

Spacecraft design fluences and damage by low energy electrons and protons are summarized. For electron energies > 5 MeV, the design fluence is 10 to the 11th power electrons/sq cm; for energies < 5 MeV, the integral spectrum is assumed to go as 1/E sq. The design fluences for proton energies > 30 MeV is 1.5 x 10 to the 9th power protons/sq cm; for energies > 100 MeV, it is 5 x 10 to the 14th power protons/sq cm. The radioisotope thermoelectric generator gamma and neutron radiation constraints are listed. Damage due to electron energies < 0.5 MeV and proton energies < 10 MeV are summarized for effects on spacecraft thermal surfaces, reflective surfaces, and refractive materials. The high frequency noise figure for field effect transistors may increase markedly, and another effect is the buildup of charge on insulating surfaces, resulting in large electric fields. N.E.N.

N72-27857* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DERIVATION OF MISSION FLUENCES FROM FLUX MODELS: PROPAGATION OF UNCERTAINTIES **c24**
Jack Barengoltz *In its* Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 143-158 (For availability see N72-27850 18-30)
(Contract NAS7-100)
CSCL 20H

The calculation of fluences from the flux models for spacecraft designers, and the propagation of uncertainties in the flux models to larger uncertainties in the final answer are discussed. Ionization and displacement damage in silicon, fluence, and a fluence of an equivalent energy are considered. Data in graph form are presented on stopping power and range curves for electrons and protons in silicon, relative electron and proton damage in silicon, and electron fluences expressed as 3 MeV equivalent and proton fluences expressed as 20 MeV equivalent for flybys in Jupiter's magnetic equatorial plane. It is concluded that the problem includes the uncertainty in peak flux, which has an immediate linear effect; uncertainty in the spatial distribution of the flux which gives great divergency between the upper-limit model and the nominal model and in the case of protons, may preclude any mission planning in order to make the situation better; and the uncertainty in the energy spectrum both in shape and energy location of the peak, if any, and which has little importance for mission planning if the spectrum is fairly constant. N.E.N.

N72-27858* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EFFECTS OF ELECTRONS AND PROTONS ON SCIENCE INSTRUMENTS **c24**
Richard H. Parker *In its* Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 159-177 refs (For availability see N72-27850 18-30)
(Contract NAS7-100)
CSCL 20H

The radiation effects on typical science instruments according to the Jupiter trapped radiation design restraint model are described, and specific aspects of the model where an improved understanding would be beneficial are suggested. The spacecraft design used is the TOPS 12L configuration. Ionization and displacement damage are considered, and damage criteria are placed on the most sensitive components. Possible protective measures are mentioned: selecting components as radiation resistant as possible, using a difference in desired and undesired signal shapes for electronic shielding, orienting and locating the component on the spacecraft for better shielding, and adding passive shields to protect specific components. Available options are listed in decreasing order of attractiveness: attempt to lower the design restraints without compromising the success of the missions, trade off experiment objectives for increased reliability, alter the trajectory, and remove sensitive instruments from the payload. N.E.N

N72-27859* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMPACT OF JOVIAN RADIATION ENVIRONMENTAL HAZARD ON SPACECRAFT AND MISSION DEVELOPMENT DESIGN

Edward Divita *In its* Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 179-202 (For availability see N72-27850 18-30)
(Contract NAS7-100)
CSCL 03B

The environmental impact on the TOPS 12L configuration is discussed. The activities in system environmental design and testing are described, and radiation design restraints based on the upper limit model are given. Range energy cutoffs in aluminum are also presented and the effective shielding thicknesses for electrons and protons of different energies are included. Design integration problems and radiation testing aspects are considered. Data are given for selecting the parts which should be tested in a formal test program, and the piece-part radiation thresholds are tabulated for electrons and protons. N.E.N.

N72-27860* Florida Univ., Gainesville.
INFORMATION FROM JUPITER'S DECAMETRIC RADIATION
Thomas D. Carr *In* JPL Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 203-221 refs (For availability see N72-27850 18-30)
CSCL 03B

Radiation associated with decametric bursts are observed from about 39.5 MHz downwards, and its occurrence probability depends partly on the central meridian longitude of Jupiter. Three central meridian longitude regions of emission are designated as Sources A, B, and C. Emissions from B and C regions are also dependent on Io's phase. The frequency band of noise storms drifts slowly up or down the spectrum. Pulses with durations of 20 microseconds display drifts at the rate of 1000 MHz/sec. Decametric data are used to estimate Jupiter's surface magnetic field strength to be 10 gauss; however, if the maximum emission, about 10 MHz, is the electron gyrofrequency at Io's orbit, the surface field strength would be about 800 gauss. A model of the emission beam control exercised by Io is summarized. Data are presented which indicate that the width of source A emissions results from the changes in the angle of Jovicentric declination of the earth. One of two recent theories places the plasmapause at least 50 Jupiter radii from the surface on the sunward side, and the other places it within Io's orbit. N.E.N.

N72-27861* California Inst. of Tech., Pasadena. Owens Valley Radio Observatory.
SOME RECENT OBSERVATIONS AND INTERPRETATION OF THE JUPITER DECIMETER EMISSION
Glenn L. Berge *In* JPL Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 223-242 refs (For availability see N72-27850 18-30)
(Grant NGR-005-002-114; Contract N00014-67-A-0094-0019; Grant NSF GP-30400X)
CSCL 03B

The decimetric emission consists partly of thermal radiation from the planetary disk and partly of nonthermal radiation from a region of larger angular extent and is thought to result from synchrotron emission by relativistic electrons in the magnetic field. Four topics relating to the decimetric emission are discussed. (1) A comparison is made of maps giving detailed brightness contours. One was obtained for epoch 1963.8 and was at a wavelength of 10.4 cm. The second was for epoch 1967.2 at 21.3 cm. (2) Interferometric data at 21.1 cm taken in April 1968 and May 1979 indicate that the emission centroid is fixed in Jupiter and rotates with it. (3) Circular polarization observations are described and are used to obtain a surface magnetic field strength at the equator between 3.2 and 15.2 gauss. (4) An upper limit on the Faraday rotation is used to set an upper limit on the density of thermal electrons surrounding Jupiter, and uncertainties in the results are discussed. N.E.N.

N72-27862* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A NOTE ON THE GLEDHILL MODEL OF THE MAGNETOSPHERE OF JUPITER
S. Gulkis *In its* Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 243-249 refs (For availability see N72-27850 18-30)
(Contract NAS7-100)
CSCL 03B

Free-free emission from a constant density, isothermal rectangular of thickness 2 Jupiter radii and side dimensions 2 x 8 radii is considered. It is determined that the free-free emission from the Gledhill model exceeds the flux measured from the planet over the entire microwave spectrum. Consequently the electron density must be considerably less than Gledhill assumed (10 to the 9th power electrons/cu cm). The upper limit to the electron density which can be set by comparing free-free emission with the observed spectrum is approximately 10 to the 7th power electrons/cu cm. Author

N72-27863* Kansas Univ., Lawrence.
DISCUSSION OF THE RELIABILITY OF ELECTRON DENSITIES AND ENERGIES INTERPRETED FROM DATA AND LIMITS ON THE PROTON ENERGY AND DENSITY
David B. Beard *In* JPL Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 251-269 refs (For availability see N72-27850 18-30)
(Contract NAS2-5603; Grants NSF GA-1592; NSF GA-14029)
CSCL 03B

Analysis of radio observations of Jupiter were changed to take into account the antenna resolution. A dipole magnetic field with a surface equatorial value of 7 gauss is assumed. The electron temperature is found to increase for $r > 2.5$ Jupiter radii with decreasing r as $1/r$ cubed, reaching a peak of about 100 MeV at $r = 2.5$ Jupiter radii. For $r < 2.5$ Jupiter radii, the electron temperature goes as r to the 6th power because of energy lost to radiation. The consequences of making an upper estimate on the proton flux by assuming the magnetic field is loaded with all the energetic protons it can hold are described. The upper limits of proton energy, density, flux, and energy flux are calculated for 1, 2, 2.5, 3, and 6 Jupiter radii. The proton energy and velocity estimates are considered to be fairly reliable; the upper limit to the number density is probably much higher than actuality. N.E.N.

N72-27864* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EFFECT OF JUPITER'S SATELLITES ON THE DIFFUSION OF PROTONS
Gilbert D. Mead *In* JPL Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 271-281 (For availability see N72-27850 18-30)
CSCL 03B

Proton diffusion data are calculated for the Jovian satellites Amalthea, Io, Europa, Ganymede, and Callisto, assuming an equatorial magnetic field at Jupiter's surface of 10 gauss. The cyclotron radius, bounce period, and drift period are calculated for 1 MeV protons. These characteristics and the proton energy at the satellite, mean life near the satellite before impact, and diffusion time are also calculated for 100 MeV protons which conserve their first adiabatic invariant. The longitudinal distance between successive bounces is of the order of a few satellite radii. N.E.N.

N72-27865* Cornell Univ., Ithaca, N.Y. School of Electrical Engineering.
ENERGETIC PROTONS IN JUPITER'S RADIATION BELTS
Neil Brice *In* JPL Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 283-313 refs (For availability see N72-27850 18-30)
(Grant NSF GA-11415)
CSCL 03B

Estimates of the location, density, and energy of energetic protons in the Jupiter radiation belts are presented. A model of the Jupiter magnetosphere is developed by scaling from the Earth magnetosphere. Solar wind parameters, and magnetic and electric field characteristics in the magnetosphere are given for

the Earth and projected for Jupiter. The upper limit of the number density of energetic protons is calculated to be 310,000/cu m, and the energy density would be about 310,000 MeV/cu m, or 51 nJ/cu m. A magnetic moment of 100 MeV/gauss for solar wind particles, a magnetic field on Jupiter's surface of 10 gauss, and a McIlwain parameter L of 7 are used. Sources of energetic particles are cosmic rays, satellite-magnetosphere interaction, and the solar wind, and their contributions are discussed. The two components of trapped energetic particle drift, one due to corotational and convective fields and the other due to gradients in the magnetic field, are described, and their periods are given. N.E.N.

N72-27866* Boeing Co., Seattle, Wash. Research and Engineering Div.

CALCULATION OF NEUTRON-DECAY-PROTON TRAPPING IN THE JOVIAN MAGNETOSPHERE

J. R. Thomas and W. R. Doherty *In* JPL Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 315-346 refs (For availability see N72-27850 18-30)

CSCL 03B

Investigations on the possible proton fluxes resulting from cosmic ray albedo neutron decay (CRAND) are summarized. It is recalled that experimental data on the earth's belts are reasonably consistent with a CRAND source for most of the protons with energies > 50 MeV in the heart of the inner belt. It is assumed that the CRAND and cosmic ray flux and spectrum for Jupiter are the same as for the Earth, with the significant difference that considerably higher energy particles are needed to reach the Jupiter atmosphere at the same magnetic latitude. The ratio of the CRAND source averaged over an L shell on Jupiter to that on Earth at L = 1.3 is derived from a geometrical calculation. The ratio of average loss rate on Jupiter to that for the Earth is also discussed. The flux around Jupiter is obtained by scaling according to the ratio of source to loss from the flux observed in the Earth's inner belt. Author

N72-27867* California Univ., Los Angeles.

STABLY TRAPPED PROTON LIMITS FOR JUPITER

Charles Kennel *In* JPL Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 347-361 (For availability see N72-27850 18-30)

CSCL 03B

A general introduction to pitch-angle diffusion for Earth and Jupiter magnetospheres is given. The instabilities which might limit the trapped fluxes in the earth magnetosphere are identified as the interchange or ballooning mode, electrostatic loss cone modes, and electromagnetic ion cyclotron wave. The instability theory of the ion cyclotron wave is discussed. This wave can be unstable only if protons can be in cyclotron resonance with the wave. The instability growth rate is proportional to the cyclotron frequency, the fractional number density of fast particles, and the anisotropy of the fast particle distribution. The critical proton energy is the lowest energy for which the stably trapped limit applies, and is calculated to be 150 MeV at L = 2 and for 10 ion pairs/cu cm. Particles above the critical threshold energy are considered and their stability limit is approximately 3 x 10 to the 10th power/sq cm/sec divided by L to the 4th power. N.E.N.

N72-27868* California Univ., Los Angeles.

A SELF-CONSISTENT MODEL FOR JUPITER'S RADIATION BELTS

Richard M. Thorne and Ferdinand V. Coroniti *In* JPL Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 363-380 (For availability see N72-27850 18-30)

CSCL 03B

The solar wind is assumed to be a sufficient source for the radiation belts of Jupiter, with radial diffusion as the process for getting the solar wind fluxes into the inner regions of the radiation belts. The process of a radial diffusion source is combined with pitch-angle diffusion losses to estimate an upper limit to the proton and electron fluxes. The upper limit to the integral proton and electron fluxes in the outer zone scale as L to the -6th power throughout the outer zone, assuming that the magnetic moment is conserved. It is important that these fluxes are above the stably trapped flux levels in the outer regions of the belts; the instability will work because the energies of the particles are above the critical value required. Author

N72-27869* Boeing Scientific Research Labs., Seattle, Wash. Environmental Sciences Lab.

WAVE PROPAGATION IN THE MAGNETOSPHERE OF JUPITER

H. B. Liemohn *In* JPL Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 381-403 refs (For availability see N72-27850 18-30)

CSCL 03B

A systematic procedure is developed for identifying the spatial regimes of various modes of wave propagation in the Jupiter magnetosphere that may be encountered by flyby missions. The Clemmow-Mullaly-Allis (CMA) diagram of plasma physics is utilized to identify the frequency regimes in which different modes of propagation occur in the magnetoplasma. The Gledhill model and the Ioannidis and Brice model of the magnetoplasma are summarized, and configuration-space CMA diagrams are constructed for each model for frequencies from 10 Hz to 1 MHz. The distinctive propagation features, the radio noise regimes, and the wave-particle interactions are discussed. It is concluded that the concentration of plasma in the equatorial plane makes this region of vital importance for radio observations with flyby missions. Local radio noise around the electron cyclotron frequency will probably differ appreciably from its terrestrial counterpart due to the lack of field-line guidance. Hydromagnetic wave properties at frequencies near the ion cyclotron frequency and below will probably be similar to the terrestrial case. N.E.N.

N72-27870* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A RESONANT INSTABILITY OF MODEL PROTON RADIATION BELTS IN THE JOVIAN MAGNETOSPHERE

Fritz Neubauer *In* JPL Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 405-417 refs (For availability see N72-27850 18-30)

CSCL 03B

The ion cyclotron instability and characteristics of the ion cyclotron wave are discussed. A mathematical perturbation technique is applied to the dispersion relations, and the results are applied to the case of propagation parallel to the magnetic field. The ion cyclotron wave is determined in its damping and growth characteristics by resonant protons and electrons, found in momentum space on resonant surfaces. In the relativistic case the resonant surfaces are hyperbolas of revolution around the magnetic field, and protons can have a stabilizing effect. Instability rates are calculated for the region in the equatorial plane with the Ioannidis and Brice density model. The upper limit of proton flux which gives an energy density of the same order of magnitude as the magnetic field energy density is obtained. The upper limit is plotted with respect to distance from Jupiter and the minimum resonant energy contributing to the instability is also plotted. N.E.N.

N72-27871* Iowa Univ., Iowa City. Dept. of Physics and Astronomy.

AN ENERGETIC CHARGED PARTICLE EXPERIMENT ON THE ASTEROID/JUPITER MISSIONS, PIONEERS F AND G

James A. VanAllen *In* JPL Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 419-444 (For availability see N72-27850 18-30)

CSCL 03B

The experiment package, consisting of seven Geiger-Mueller tubes as basic sensors, is described, including the instrumental characteristics and tube arrangements. The capabilities of surveying the absolute intensities, energy spectra, angular distributions of energetic electrons and protons in the Jupiter magnetosphere are discussed. N.E.N.

N72-27872* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ASSESSMENT OF JUPITER'S TRAPPED RADIATION BY PIONEER
John D. Mihalov *In* JPL Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 445-472 refs (For availability see N72-27850 18-30)
CSCL 03B

The experiments planned for Pioneers F and G during their Jupiter flybys are discussed. The complement includes four energetic charged particle experiments: University of Iowa package consisting of Geiger-Mueller tubes; University of California, San Diego, trapped radiation package consisting of solid state detectors, thin scintillators, and an alcohol water Cerenkov radiator; University of Chicago package containing charged particle detectors; and a Goddard Space Flight Center package containing solid state, cosmic ray detectors. Other experiments are the Jet Propulsion Laboratory magnetometer and the Ames Research Center plasma analyzer. Pitch angle distributions at Jupiter, and the capabilities for unambiguous identification of energetic protons at Jupiter are also discussed.
N.E.N.

N72-27873* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CONCLUSION
Andrew J. Beck, Jr. *In its* Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 473-509 (For availability see N72-27850 18-30)
CSCL 03B

A set of models was established for the Jupiter electron and proton trapped radiation belt which could be used in the determination of outer planets mission spacecraft design requirements. Two models each for the electron and proton components evolved: a nominal or best estimate model, and an upper limit model. The models are described by presenting the assumptions that were agreed to be then best basis for the models at this time, and then describing the models which were structured in the time available. The discussion which took place at the final session is also presented.
Author

N72-27874* California Inst. of Tech., Pasadena.
COMMENTS ON MODELS OF THE JOVIAN RADIATION BELTS
Leverett Davis, Jr. *In* JPL Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 517-525 (For availability see N72-27850 18-30)
CSCL 03B

The proposed model for Jupiter radiation belts is considered. It is compared to alternative nominal models. Their disadvantages are discussed.
K.P.D.

N72-27875* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
POST-WORKSHOP MODELS OF JUPITER'S RADIATION BELTS
Neil Divine *In its* Proc. of the Jupiter Radiation Belt Workshop 1 Jul. 1972 p 527-542 refs (For availability see N72-27850 18-30)
(Contract NAS7-100)
CSCL 03B

Models for the charged particle populations of Jupiter's trapped radiation belts were derived at the Jupiter Radiation Belt Workshop on the basis of several assumptions which represented a consensus of opinion. It was possible to improve the models on the basis of work performed after the workshop concluded. These improvements affect the models in two ways. The effects of special relativity on the particle energy and flux dependences in the magnetosphere were included in a derivation based on L-shell diffusion with conservation of the magnetic moment. Quantitative conclusions are available for the limit which ion cyclotron instability places on the proton population. A set of models which incorporates these developments in a way consistent with the original workshop assumptions and conclusions is described.
Author

N72-27876*# Martin Marietta Corp., Denver, Colo.
A STUDY OF SYSTEM REQUIREMENTS FOR PHOBOS/DEIMOS MISSIONS. VOLUME 1: SUMMARY Final Report, 4 Jun. 1971 - 4 Jun. 1972
Jun. 1972 128 p refs 4 Vol.
(Contract NAS1-10873)
(NASA-CR-112077-1) Avail: NTIS HC $8.50 CSCL 22A

The technical feasibility of accomplishing a variety of cost-effective missions to the satellites of Mars were investigated. Three mission options were studied: a basic satellite rendezvous and landing mission, a satellite sample return mission, and a combination Mars landing and Phobos/Deimos exploration mission. Nominal science payloads and supporting subsystems were defined for each mission design. Configuration layouts, program schedules, and cost estimates were also developed for each option. Environmental criteria unique to the mission were developed. Supporting studies, research, and technology requirements were identified.
Author

N72-27877*# Martin Marietta Corp., Denver, Colo.
A STUDY OF SYSTEM REQUIREMENTS FOR PHOBOS/DEIMOS MISSIONS. VOLUME 2: PHASE 1 RESULTS, SATELLITE RENDEZVOUS AND LANDING MISSIONS Final Report, 4 Jun. 1971 - 4 Jun. 1972
Jun. 1972 305 p refs 4 Vol.
(Contract NAS1-10873)
(NASA-CR-112077-2) Avail: NTIS HC $17.25 CSCL 22B

The feasibility of a satellite rendezvous, landing, and roving mission to the Martian satellites Phobos and Deimos is considered. Mission-oriented analysis, systems analysis, and conceptual design studies are presented.
K.P.D.

N72-27878*# Martin Marietta Corp., Denver, Colo.
A STUDY OF SYSTEM REQUIREMENTS FOR PHOBOS/DIEMOS MISSIONS. VOLUME 3: PHASE 2 RESULTS, SATELLITE SAMPLE RETURN MISSIONS AND SATELLITE MOBILITY CONCEPTS Final Report, 4 Jun. 1971 - 4 Jun. 1972
Jun. 1972 299 p refs 4 Vol.
(Contract NAS1-10873)
(NASA-CR-112077-3) Avail: NTIS HC $17.00 CSCL 22A

The scientific objectives were considered for a Phobos/Deimos mission. The payloads for a minimum useful instrument complement were developed. The rationale for a sample return mission is discussed, along with the scientific constraints and requirements for the acquisition of samples.
Author

N72-27879*# Martin Marietta Corp., Denver, Colo.
A STUDY OF SYSTEM REQUIREMENTS FOR PHOBOS/DEIMOS MISSIONS. VOLUME 4: PHASE 3 RESULTS, COMBINED MISSIONS TO MARS AND ITS SATELLITES Final Report, 4 Jun. 1971 - 4 Jun. 1972
Jun. 1972 171 p 4 Vol.
(Contract NAS1-10873)
(NASA-CR-112077-4) Avail: NTIS HC $10.75 CSCL 22A

Combined missions to Mars and Phobos/Deimos were considered in relation to large scientific returns at a low total cost. A matrix of all feasible major combined mission concepts was compiled. The most promising approach was selected from which a nominal mission profile was developed. A systems analysis was performed to trade off performance, configuration, and cost characteristics of candidate mission concepts. Configuration and subsystem optimization analysis were then conducted from which a baseline and an alternate program were selected. Program schedules and cost estimates were prepared for the recommended and alternate program.
Author

N72-27880*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APOLLO 16 GEOCHEMICAL X-RAY FLUORESCENCE EXPERIMENT: PRELIMINARY REPORT
I. Adler, J. Trombka, J. Gerard (NAS-NRC), P. Lowman, R.

Schmadebeck, H. Blodget, E. Eller, L. Yin, R. Lamothe, G. Osswald (Cincinnati Univ.) et al Jun. 1972 15 p refs
(NASA-TM-X-65918; X-641-72-198) Avail: NTIS HC $3.00 CSCL 03B

The lunar surface was mapped with respect to Mg, Al, and Si, as Al/Si and Mg/Si ratios along the projected ground tracks swept out by the orbiting Apollo 16 spacecraft. The results confirm the observations made during the Apollo 15 flight and provide data for a number of features not covered before. The data are consistent with the idea that the moon has a widespread differentiated crust (the highlands). The Al/Si and Mg/Si chemical ratios correspond to that for anorthositic gabbro through gabbroic anorthosites or feldspathic basalts. The X-ray results suggest the occurrence of this premare crust or material similar to it as the Descartes landing site. Author

N72-27881# Joint Publications Research Service, Arlington, Va.
DOCKING TRAINING AND TELEMETRY
11 Jul. 1972 17 p Transl. into ENGLISH from Aviat. Kosmonavt. (USSR), no. 5, May 1972 p 32-35
(JPRS-56464) Avail: NTIS HC $3.00

The docking of manned spacecraft and radio telemetry are considered. For individual titles, see N72-27882 through N72-27883.

N72-27882 Joint Publications Research Service, Arlington, Va.
FOR A RENDEZVOUS IN ORBIT **c05**
E. Anisimov *In its* Docking Training and Telemetry 11 Jul. 1972 p 1-7 (For availability see N72-27881 18-30)

The use of specialized and multipurpose simulators is discussed in connection with developing the skill of cosmonauts in spacecraft docking. Author

N72-27883 Joint Publications Research Service, Arlington, Va.
OVER TELEMETRY CHANNELS **c07**
V. Borisov *In its* Docking Training and Telemetry 11 Jul. 1972 p 8-13 (For availability see N72-27881 18-30)

Radio telemetric systems for transmitting scientific and technical information from space are considered. Various types of apparatus and their use are discussed. Author

N72-27884# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 279
30 Jun. 1972 57 p refs Transl. into ENGLISH from Russian reports
(JPRS-56398) Avail: NTIS HC $5.00

Translations and abstracts of articles are presented on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports. Published details of Soviet space spectaculars are included. Author

N72-27885*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATS SIMULTANEOUS AND TURNAROUND RANGING EXPERIMENTS
John S. Watson and Barbara H. Putney Nov. 1971 45 p refs
(NASA-TM-X-65920; X-552-71-495) Avail: NTIS HC $4.25 CSCL 22A

This report explains the data reduction and spacecraft position determination used in conjunction with two ATS experiments - Trilateration and Turnaround Ranging - and describes in detail a multilateration program that is used for part of the data reduction process. The process described is for the determination of the inertial position of the satellite, and for formating input for related programs. In the trilateration procedure, a geometric determination of satellite position is made from near simultaneous range measurements made by three different tracking stations. Turnaround ranging involves two stations; one, the master station, transmits the signal to the satellite and the satellite retransmits the signal to the slave station which turns the signal around to the satellite which in turn retransmits the signal to the master station. The results of the satellite position computations using the multilateration program are compared to results of other position determination programs used at Goddard. All programs give nearly the same results which indicates that because of its simplicity and computational speed the trilateration technique is useful in obtaining spacecraft positions for near synchronous satellites. Author

N72-27886*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ORIGIN OF THE MOON: NEW DATA FROM OLD ROCKS
Bevan M. French May 1972 103 p refs Original contains color illustrations
(NASA-TM-X-65924; X-644-72-157) Avail: NTIS HC $7.25 CSCL 03B

Knowledge of the moon is reviewed, particularly that obtained from Apollo 11 and 12 samples, to provide a framework for the geological results from the Apollo 15 mission. The three main theories that have resulted from the Apollo data are briefly discussed, and a review of modern lunar exploration is presented. The knowledge acquired from the Apollo missions is summarized and includes: (1) The rocks of the maria are from 3.3 to 3.7 billion years old, and the highlands are probably 4.6 billion years old. (2) Only small moonquakes are detected, and these appear related to tidal stresses produced by moon swings in its orbit. (3) The moon has a very weak magnetic field. (4) The moon was once hot enough to melt its interior. F.O.S.

N72-27887*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ROLE OF GAS SURFACE INTERACTIONS IN THE REDUCTION OF OGO-6 NEUTRAL GAS PARTICLE MASS SPECTROMETER DATA
A. E. Hedin, B. B. Hinton (Michigan Univ., Ann Arbor), and G. A. Schmitt (Michigan Univ., Ann Arbor) Mar. 1972 46 p refs
(NASA-TM-X-65923; X-621-72-90) Avail: NTIS HC $4.50 CSCL 03B

The gas-surface interaction effects observed by the quadrupole mass spectrometer are described, and the technique developed to account for them in determining ambient neutral densities is summarized. The total ion current and the ion currents for ions with molecular weights 2, 4, 16, 28, and 32 are sampled for 1.125 sec once every 9.216 sec, for 258 sec out of a 368 sec cycle. An equation is given for the number density of any constituent in the ion source region, and source density data are discussed. The mass 28 background gas is considered to be CO rather than N2, and a CO model is developed. A quasi-equilibrium model of the atomic oxygen interactions is constructed, and a set of surface parameters is determined which provides a reasonable fit to the mass 16 and 32 source densities consistent with the predicted ambient atomic oxygen. N.E.N.

N72-27888*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FURTHER ANALYSIS OF THE VENUS ATMOSPHERE MEASUREMENTS
John E. Ainsworth and Jay R. Herman Jun. 1972 91 p refs Submitted for publication
(NASA-TM-X-65929; X-625-72-187) Avail: NTIS HC $6.75 CSCL 03B

Plots of the Mariner 5 and Venera 4, 5, and 6 pressure vs temperature data show that the Venera profiles are essentially congruent with the Mariner 5 day and night profiles, but are displaced 28% higher in pressure. There is evidence that this displacement is a characteristic of the Venus atmosphere that arises from a latitude dependence of the height of the isotherms caused primarily by dynamic processes. The available data is used to calculate a model of the structure of the Venus atmosphere for the first 75 km above the equatorial region. Author

N72-27889*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DETECTION OF INTERPLANETARY ELECTRONS FROM 18 keV TO 1.8 MeV DURING SOLAR QUIET TIMES, 1. ON THE ORIGIN OF 200 KeV INTERPLANETARY ELECTRONS, 2.
R. P. Lin (Calif. Univ., Berkeley), K. A. Anderson (Calif. Univ., Berkeley), T. L. Cline, R. Ramaty, and L. A. Fisk Jun. 1972 14 p refs Submitted for publication
(NASA-TM-X-65935; X-661-72-221) Avail: NTIS HC $3.00 CSCL 03B

A quiet time component of interplanetary electrons having energies above solar wind energies and below those characterized as cosmic radiation was observed. Its energy spectrum falls with energy from 18 keV to 1.8 MeV, but it shows a feature in the 100 to 300 keV range. The observed temporal variations of the intensity suggest that the 18 to 100 keV portion is solar and the 0.3 to 1.8 MeV portion is galactic in origin. Solar and terrestrial neutron decay electrons appear inadequate to explain the 100 to 300 keV feature. Author

N72-27890# Joint Publications Research Service, Arlington, Va.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 280
7 Jul. 1972 36 p Transl. into ENGLISH from Russian reports
(JPRS-56444) Avail: NTIS HC $4.00

Translations and abstracts of articles are presented on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports. Published details of Soviet space spectaculars are included. Author

N72-27891*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
VARIATIONAL DIFFERENTIAL EQUATIONS FOR ENGINEERING TYPE TRAJECTORIES CLOSE TO A PLANET WITH AN ATMOSPHERE
E. D. Dickmanns 29 Mar. 1972 49 p refs
(NASA-TM-X-64679) Avail: NTIS HC $4.50 CSCL 22A

The differential equations for the adjoint variables are derived and coded in FORTRAN. The program is written in a form to either take into account or neglect thrust, aerodynamic forces, planet rotation and oblateness, and altitude dependent winds. Author

N72-27892# National Aerospace Lab., Tokyo (Japan).
INERTIAL FORCE FIELD DUE TO NUTATIONAL MOTION OF A SPINNING AXISYMMETRIC SATELLITE AND ITS APPLICATION TO NUTATION DAMPERS
Chikara Murakami and Yoshiaki Ohkami Nov. 1971 14 p refs In JAPANESE; ENGLISH summary
(NAL-TR-251) Avail: NTIS HC $3.00

The motion of a nutation damper on spin-stabilized axisymmetric spacecraft was analyzed. The force with nutation frequency was evaluated along an arbitrary direction of motion at an arbitrary position of the satellite. The pattern of the inertial force field is given. Combining the results and the energy sink approximation method, nutation damping rate was evaluated in terms of moments of inertia, spinning rate, and initial nutation angle for arbitrary mounting of the damper. Author

N72-27893# Czechoslovak National Committee of COSPAR, Prague.
SPACE RESEARCH ACTIVITIES IN CZECHOSLOVAKIA IN 1971
1971 20 p refs
Avail: NTIS HC $3.00

Data and experiments obtained from Intercosmos satellite flights are discussed. Solar and VLF phenomena, electron temperature, and meteor dust were studied. Ground-based research included satellite tracking, laser ranging radar, and satellite geodesy. The solar magnetic field distribution, proton flares, and solar wind interaction with the earth were investigated. Satellite meteorology, interplanetary matter, and radiation tolerance are among the subjects also considered. K.P.D.

N72-27894*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMP F AND G PHASE 1 MAGNETIC FIELD ANALYSIS
William Mish Apr. 1972 70 p refs
(NASA-TM-X-63086; X-612-67-602-Rev) Avail: NTIS HC $5.50 CSCL 22A

The program developed to analyze magnetic field data from the magnetic field experiment flown in IMP F is reported. The analysis converts the raw X, Y, Z sensor data as received on the magnetic field experiment tape into vector measurements of the ambient magnetic field observed by the experiment. These data are computed for four frames of reference -- apparent, payload, solar ecliptic and solar magnetospheric. In addition 20.45 second statistics are computed for the last three coordinate systems. Finally, a summary tape is produced containing detailed data and sequence statistics as well as the output from the autocorrelation computer, trajectory data and identification information. Author

N72-27895# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON EASTERN EUROPE - SCIENTIFIC AFFAIRS, NO. 256
11 Jul. 1972 43 p Transl. into ENGLISH from various eastern European publications
(JPRS-56460) Avail: NTIS HC $4.25

Articles concerning the development of and progress in the various theoretical and applied scientific disciplines and technical fields are presented. The administration, structure, personnel, and research plans of leading East European scientific organizations and institutions, particularly the academies of sciences, are reported. Author

N72-27896# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany). Inst. fuer Extraterrestrische Physik.
[ACTIVITIES OF THE INSTITUT FUER EXTRATERRESTRISCHE PHYSIK] Annual Report, 1971 [TAETIGKEITSBERICHT 1971 DES INSTITUTS FUER EXTRATERRESTRISCHE PHYSIK AM MAX-PLANCK-INSTITUT FUER PHYSIK UND ASTROPHYSIK]
Jan. 1972 129 p In GERMAN
(MPI-PAE-Extraterr-59) Avail: NTIS HC $8.50

The barium cloud experiment at 32,000 km altitude, is reviewed. A vaporizing technique for barium using hollow charges was developed and tested. It was used in vaporizing experiments of metal atoms. The processing phase of Azur satellite data was terminated, and several scientific projects based on these data were completed. ESRO

N72-27897# Royal Aircraft Establishment, Farnborough (England).
DENSITY VARIATIONS IN THE EXOSPHERE FROM JUNE 1968 TO DECEMBER 1970
G. E. Cook Jul. 1971 30 p refs
(RAE-TR-71150; BR26986) Avail: NTIS HC $3.50

Two satellites, Calsphere (1964-63C) and Dodecapole (1965-16G), were used to determine weekly mean values of atmospheric density at heights near 1070 and 900 km respectively, between June 1968 and December 1970. After correcting the values of density to both a fixed height and a fixed level of solar activity, the progress of the semiannual variation in the exosphere was traced for 2 1/2 years of high solar activity. The semiannual variation in density is large, with the average value for the ratio of the October maxima to the July minima being about 21. When the results are combined with earlier data from Echo 2, there is evidence of a strong oscillation in the amplitude with a periodicity of three years.
Author (ESRO)

N72-27898# Royal Aircraft Establishment, Farnborough (England).
TABLE OF SPACE VEHICLES LAUNCHED DURING THE YEARS 1958 - 1971
H. Hiller and J. A. Pilkington (Scarborough Planetarium, Engl.) Jan. 1972 35 p refs
(RAE-TR-72004; BR28255) Avail: NTIS HC $3.75

All known space vehicles launched before 1 January 1972, excluding satellites in geocentric orbits, are tabulated. Details are given of mass, size, shape, orbit, time of launch and other useful information. The table is divided into five sections under the headings: (1) Heliocentric orbits, (2) Orbits in the earth-moon system, (3) selenocentric orbits - earth launch, selenocentric orbits - moon launch, and (5) areocentric orbits Author (ESRO)

N72-27899# Royal Aircraft Establishment, Farnborough (England).
EQUATIONS FOR 15TH ORDER GEOPOTENTIAL COEFFICIENTS FROM THE ORBIT OF TRANSIT 1B
H. Hiller and D. G. King-Hele Jan. 1972 30 p refs
(RAE-TR-72003; BR28286) Avail: NTIS HC $3.50

The computer program PROP was used to re-determine in greater detail the orbit of satellite Transit 1B, using a modified method on occasions when the number of observations was previously thought to be too few to determine the orbit. The satellite had an orbital inclination of about 51 deg and it was possible to determine inclination accurately using only a small number of visual observations from latitudes near 51 deg N. The region of 15th-order resonance revealed by a steep decrease in inclination of about 0.04 deg was investigated between March and November 1962. The analysis leads to equations for the 15th-order geopotential coefficients, and an improved value is obtained for the average rotation rate of the upper atmosphere at a mean height of 380 km between 1963 and 1967.
Author (ESRO)

N72-27900# Royal Aircraft Establishment, Farnborough (England).
MEASUREMENTS OF UPPER-ATMOSPHERE ROTATIONAL SPEED FROM CHANGES IN SATELLITE ORBITS
D. G. King-Hele Aug. 1971 18 p refs
(RAE-TR-71171; BR26903) Avail: NTIS HC $3.00

A review of recent satellite orbits confirms the previous finding that the upper atmosphere at heights of 200 to 350 km rotates on average faster than the Earth, and that the average rate of rotation increases with height from about 1.1 rev/day at 200 km to nearly 1.4 rev/day at 350 km. However, it appears that the rotation rate decreases above 350 km, to about 1.0 rev/day at 420 km and 0.7 rev/day at 500 km. In addition, new studies at heights of 120 to 230 km indicate wide variations in the rotation rate over short time intervals. Author (ESRO)

N72-27901# Arizona Univ., Tucson.
GROUNDBASED INFRARED OBSERVATIONS OF CELESTIAL SOURCES
Frank J. Low 31 Aug. 1971 19 p
(Contract F19628-70-C-0046; Contract F19628-70-C-0046; ARPA Order 1366; AF Proj. 8692)
(AD-739196; AFCRL-71-0594; Rept-3) Avail: NTIS CSCL 04/1

The Electro-Dynamics Laboratories of Utah State University has modified the AFCRL trainable-instrumentation mount originally fabricated by Cook Electric Company so that it can be used as a tracking platform for two Type-III interferometers and one radiometer. The modification basically involved the addition of vibration isolation mounts and an enclosure with temperature control for the entire system which will be mounted in a KC-135 aircraft (3120). A dual-channel radiometer was designed and fabricated to fit in the remaining available mount space after the two interferometers had been installed. In connection with the readiometer design, an existing AFCRL radiometer originally built by GCA was evaluated to determine its usefulness in making airglow measurements. In addition to the :Cook: mount modifications, a manually trainable mount was fabricated to incorporate one interferometer, one radiometer and a 16-mm camera. Also, an NIR radiometer was modified to be used for hand-operated tracking and the rapid-scan spectrometer was updated to increase its sensitivity and reduce its noise level.
Author (GRA)

N72-27902# Aerospace Corp., El Segundo, Calif. Lab. Operations.
THE OBSERVATIONS OF SAR ARCS FROM THE OV1-10 SATELLITE Technical Report, Dec. 1966 - Mar. 1967
Samuel R. LaValle and David D. Elliott 15 Dec. 1971 33 p refs
(Contract F040701-71-C-0172)
(AD-737544; TR-0172(2260-10)-7; SAMSO-TR-72-38) Avail: NTIS CSCL 04/1

Three mid-latitude red arcs were measured by the night airglow photometer on board the OV1-10 (1966-111B) satellite during the winter of 1966-1967. One arc was observed as a conjugate phenomenon. Another arc was observed for two days at a constant local time and was found to decrease in intensity, increase in width, and move to higher L-values with universal time. Both of these arcs were found to be associated with the plasmapause, the location of which was determined from the VLF measurements made from the OV3-3 (1966-70A) satellite. These observations are shown to be consistent with the theory that SAR arcs are generated at the plasmapause as a consequence of the turbulent dissipation of ring current energy. Author (GRA)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N72-27903* National Aeronautics and Space Administration, Washington, D.C.
ENVIRONMENTAL STATEMENT FOR NATIONAL AERONAUTICS AND SPACE ADMINISTRATION OFFICE OF MANNED SPACE FLIGHT APOLLO PROGRAM Final Environmental Impact Statement.
16 Mar. 1972 20 p refs
(NASA-TM-X-68544) Avail: NASA Public Document Rooms, $1.00 CSCL 22B

An environmental impact statement for the Apollo Project is submitted. The Apollo Project is an existing flight project of NASA which has achieved successful lunar missions. Ten Apollo-Saturn 5 missions have demonstrated minimal environmental impact and no adverse environmental effects. The Apollo Project was initiated prior to enactment of the National Environmental Policy Act. Alternatives were considered with respect to different ways of accomplishing the lunar landing objective. The alternatives represented insignificant differences in environmental impact. Author

N72-27904* National Aeronautics and Space Administration, Washington, D.C.
ENVIRONMENTAL STATEMENT FOR PIONEER F/G PROGRAM Final Environmental Impact Statement
Jan. 1972 39 p refs
(NASA-TM-X-68543) Avail: NASA Public Document Rooms, $1.00 CSCL 22B

Aspects of the Pioneer F/G program that may affect environmental quality are discussed, including the launch vehicle and spacecraft. Effects of normal and abnormal launches, engine tests, aborted flights, and accidents are also considered. J.A.M.

N72-27905* National Aeronautics and Space Administration, Washington, D.C.
ENVIRONMENTAL STATEMENT FOR NATIONAL AERONAUTICS AND SPACE ADMINISTRATION SKYLAB PROGRAM Final Environmental Impact Statement
5 May 1972 11 p ref
(NASA-TM-X-68553) Avail: NASA Public Document Rooms, $1.00 CSCL 22B

An environmental impact statement for the Skylab program is submitted. The objectives of the Skylab program and the operational aspects of a typical mission are described. The largest potential impact on the environment is associated with the Saturn 5 launch vehicle. The magnitude and possible effects of this vehicle on the atmosphere, the ocean, and humans are the same as for the Apollo Project and are considered to produce no detrimental environmental impact. The Skylab program was initiated prior to the National Environment Policy Act. Alternative configurations were considered during the planning phase of the program. Differences in environmental impact are considered insignificant. Author

N72-27906* National Aeronautics and Space Administration, Washington, D.C.
ENVIRONMENTAL STATEMENT FOR EARTH RESOURCES TECHNOLOGY SATELLITE PROGRAM Draft Environmental Impact Statement
Mar. 1971 6 p
(NASA-TM-X-68552) Avail: NASA Public Document Rooms, $1.00 CSCL 22B

An environmental impact statement for the Earth Resources Technology Satellite program is presented. The mission of the ERTS-A and ERTS-B satellites is described. The methods for acquiring new and extensive data directly relating to conservation of the environment are described. It is concluded that no depletion of natural resources will result from the ERTS program. Author

N72-27907* National Aeronautics and Space Administration, Washington, D.C.
ENVIRONMENTAL STATEMENT FOR TIROS PROGRAM Draft Environmental Impact Statement
25 Mar. 1971 9 p ref
(NASA-TM-X-68551) Avail: NASA Public Document Rooms, $1.00 CSCL 22B

A draft of the environmental impact statement for the TIROS program is presented. The mission of the TIROS satellite and its accomplishments are described. It is concluded that there are no irreversible and irretrievable commitments of natural resources involved in the continuation of the TIROS program. Author

N72-27908* National Aeronautics and Space Administration, Washington, D.C.
ENVIRONMENTAL STATEMENT FOR NIMBUS PROGRAM Draft Environmental Impact Statement
Mar. 1971 6 p
(NASA-TM-X-68554) Avail: NASA Public Document Rooms, $1.00 CSCL 22B

An environmental impact statement for the Nimbus program is submitted. The accomplishments of the program are discussed. Plans for future launches are described. It is concluded that the exhaust gases from the launch vehicles used with the Nimbus satellite have no detrimental environmental impact. The benefits of the program are discussed and it is stated that no depletion of natural resources will result from the program. Author

N72-27909* National Aeronautics and Space Administration, Washington, D.C.
ENVIRONMENTAL STATEMENT FOR PHYSICS AND ASTRONOMY SOUNDING ROCKET, BALLOON, AND AIRBORNE RESEARCH PROGRAMS Draft Environmental Impact Statement
Mar. 1971 6 p
(NASA-TM-X-68556) Avail: NASA Public Document Rooms, $1.00 CSCL 16A

An environmental impact statement for physics and astronomy sounding rocket, balloon, and airborne research programs is submitted. The accomplishments of the programs are described. The benefits of the programs are discussed. It is stated that the largest potential impact on the environment is associated with the products of combustion from the sounding rocket exhaust. It is concluded that little or no depletion of natural resources will result from the programs. Author

N72-27910* National Aeronautics and Space Administration, Washington, D.C.
ENVIRONMENTAL STATEMENT FOR THE SPACE SHUTTLE PROGRAM Final Environmental Impact Statement
Jul. 1972 132 p refs
(NASA-TM-X-68541) Avail: NASA Public Document Rooms, $1.00 CSCL 22B

An environmental impact statement for the Space Shuttle program is presented. The program objectives and benefits are discussed. The geographical locations are identified and the environmental effects of the mission sequence are examined. Possible adverse effects due to air pollution, sonic boom, and orbiter tank reentry are defined. Other aspects of the operation which are included are land use, social, cultural and demographic effects, and solid wastes. It is concluded that the environmental effects of the shuttle are localized and of relatively short duration. The economic benefits of the program should outweigh the environmental problems Author

N72-27911*# Martin Marietta Corp., Denver, Colo.
SPACE SHUTTLE PROPULSION SYSTEMS ON-BOARD CHECKOUT AND MONITORING SYSTEM DEVELOPMENT STUDY (EXTENSION). VOLUME 1: SUMMARY AND TECHNICAL RESULTS Final Report
Apr. 1972 208 p ref 2 Vol.
(Contract NAS8-25619)
(NASA-CR-123712; MCR-72-41-Vol-1) Avail: NTIS HC $12.50 CSCL 22B

An analysis was conducted of the space shuttle propulsion systems to define the onboard checkout and monitoring function. A baseline space shuttle vehicle and mission were used to establish the techniques and approach for defining the requirements. The requirements were analyzed to formulate criteria for implementing the functions of preflight checkout, performance monitoring, fault isolation, emergency detection, display, data storage, postflight evaluation, and maintenance retest. Author

N72-27912*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SPACE STATION EXECUTIVE SUMMARY
Apr. 1972 75 p
(Contract NAS8-25140)
(NASA-CR-123719; MDC-G2727; MSFC-DPD-235) Avail: NTIS HC $5.75 CSCL 22B

An executive summary of the modular space station study is presented. The subjects discussed are: (1) design characteristics, (2) experiment program, (3) operations, (4) program description, and (5) research implications. The modular space station is considered a candidate payload for the low cost shuttle transportation system. P.N.F.

N72-27913*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
IMPACT OF LOW COST REFURBISHABLE AND STANDARD SPACECRAFT UPON FUTURE NASA SPACE PROGRAMS. PAYLOAD EFFECTS FOLLOW-ON STUDY Final Report
30 Apr. 1972 254 p
(Contract NASw-2312)

(NASA-CR-127117; LMSC-D157926) Avail: NTIS HC $14.75 CSCL 22B

The study has concluded that there are very large space program cost savings to be obtained by use of low cost, refurbishable, and standard spacecraft in conjunction with the shuttle transportation system. The range of space program cost savings for three different groups of programs are shown in quantitative terms. The total savings for the 91 programs will range from $13.4 billion to $18.0 billion depending on the degree of hardware standardization. These savings, principally resulting from payload cost reductions, tangibly support the development costs of the shuttle system. Author

N72-27914*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
IMPACT OF LOW COST REFURBISHABLE AND STANDARD SPACECRAFT UPON FUTURE NASA SPACE PROGRAMS. PAYLOAD EFFECTS FOLLOW-ON STUDY, APPENDIX Final Report
30 Apr. 1972 461 p
(Contract NASw-2312)
(NASA-CR-127118; LMSC-D157926-App) Avail: NTIS HC $25.25 CSCL 22B

Mission analysis is discussed, including the consolidation and expansion of mission equipment and experiment characteristics, and determination of simplified shuttle flight schedule. Parametric analysis of standard space hardware and preliminary shuttle/payload constraints analysis are evaluated, along with the cost impact of low cost standard hardware. J.A.M.

N72-27915*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SPACE SHUTTLE HORIZONTAL FLIGHT TEST PLAN
Robert L. Mosley 7 Jan. 1972 89 p refs
(NASA-TM-X-68515; KSC-TR-1144) Avail: NTIS HC $6.50 CSCL 22A

A horizontal takeoff flight test concept for testing space shuttle vehicles is presented. The guidelines used in planning and support requirements for the flight tests are developed. Details of the test program are provided. The instrumentation requirements are defined. The limitations imposed by the short flight endurance and restricted maneuvering capability of the shuttle booster/orbiter in the horizontal mode are described. The test program covers the following investigations. (1) stall and lift boundary tests, (2)takeoff and landing tests, (3) level flight speed power tests, (4) longitudinal and laterial directional dynamic stability, and (5) static directional stability. P.N.F.

N72-27916*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
APOLLO/SATURN C00.00.19.3 OPERATIONS AND MAINTENANCE. CATHODIC PROTECTION OF COMMUNICATION CABLES
1 Mar. 1972 106 p Revised
(KSC-TM4-275-MI; NASA-TM-X-68540) Avail: NTIS HC $7.50 CSCL 22B

Operating and maintenance instructions for cathodic protection of communication cables at the Cape Kennedy Launch Complex are presented. The system is designed to prevent or arrest corrosion of communication cables buried in soil or submerged in water by impressing sufficient direct current from the rectifier through the anodes to the cable. This process neutralizes or counteracts current flowing from the cable into the soil or water, thus preventing or arresting corrosion of the cable sheath material. Author

N72-27917*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
APOLLO/SATURN 5 SPACE VEHICLE COUNTDOWN. VOLUME 2: TURNAROUND FROM SCRUB
15 Mar. 1972 135 p refs
(NASA-TM-X-68516; KSC-K-V-0513-2-Vol-2-Rev-3) Avail: NTIS HC $8.75 CSCL 22D

The procedures required to prepare a space vehicle for subsequent launch attempt after cancelling lift-off activities are presented. The cancellation must occur after the start of cryogenic loading, but prior to initiation of ignition sequences. The sequence of operations necessary to return the space vehicle to a predetermined configuration at which time the launch count can be resumed or rescheduled for following launch opportunities is developed. The considerations and constraints that are the basis for the scrub/turnaround times are described. P.N.F.

N72-27918*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SKYLAB CONSOLIDATED INSTRUMENTATION PLAN FOR SL-1/SL-2
D. E. Clark 15 Apr. 1972 104 p refs
(NASA-TM-X-68520; KHB-8410.X) Avail: NTIS HC $7.25 CSCL 22B

The consolidated instrumentation plan is presented for employing optical and electronic data acquisition systems to monitor the performance and trajectory of Skylab 1 and Skylab 2 vehicles during the launch phase. Telemetry, optical, and electronic tracking equipment on board the vehicles, and data acquisition systems monitoring the flights are discussed. Flight safety instrumentation, vehicle data transmission systems, and instrumentation geography are also described. Author

N72-27919*# General Dynamics/Convair, San Diego, Calif.
RESEARCH AND APPLICATIONS MODULES (RAM). PHASE B STUDY: EXECUTIVE SUMMARY
12 May 1972 37 p refs
(Contract NAS8-27539)
(NASA-CR-123733; GDCA-DDA72-009) Avail: NTIS HC $4.00 CSCL 22B

The design, development, and characteristics of the Research and Applications Module (RAM) system is discussed. The RAM system is a family of payload carriers that can be delivered to and retrieved from low earth orbit by the space shuttle. The RAM payload carriers are used to support diverse technological and scientific investigations. The NASA study objectives, the relationship of the RAM payload carriers to other systems in the orbital space program, and recommendations for additional effort are presented. Author

N72-27920*# Teledyne Brown Engineering, Huntsville, Ala.
SKYLAB EXPERIMENT PERFORMANCE EVALUATION MANUAL. APPENDIX R: EXPERIMENT T020 FOOT CONTROLLED MANEUVERING UNIT (MSFC)
B. B. Tonetti Mar. 1972 70 p refs
(Contract NAS8-21804)
(NASA-CR-61386-APP-R) Avail: NTIS HC $5.50 CSCL 22B

A series of analyses for experiment T020, foot controlled maneuvering unit (MSFC), to be used for evaluating the performance of the Skylab corollary experiments under preflight, inflight and post-flight conditions is reported. Experiment contingency plan procedure and malfunction analyses are presented in order to assist in making the experiment operationally successful. Author

N72-27921*# National Aeronautics and Space Administration, Washington, D.C.
INTELSAT 4: PRESS KIT
6 Jun. 1972 10 p
(NASA-TM-X-68518) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 22A

A news release is presented which was issued prior to the expected launching of Intelsat 4 between June 13 and June 19, 1972. The planned orbit and positioning of the satellite are defined, and the mission objectives are described. In addition, background information is provided which includes descriptions of the spacecraft, launch vehicle, and launch window. D.L.G.

N72-27922*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
REFURBISHMENT COST STUDY OF THE THERMAL PROTECTION SYSTEM OF A SPACE SHUTTLE VEHICLE. PHASE 2: SUPPLEMENT Final Report
D. W. Haas and V. M. Gerler 12 Jul. 1972 182 p refs
(Contract NAS1-10990)
(NASA-CR-112034-1) Avail: NTIS HC $11.25 CSCL 22B

The labor costs and techniques associated with the maintenance of a bonded-on ablator thermal protection system (TPS) concept, suitable for Space Shuttle application are examined. The baseline approach to TPS attachment involves bonding reusable surface insulation (RSI) and/or ablators to the structural skin of the vehicle. The RSI and/or ablators in the form of either flat or contoured panels can be bonded to the skin of the primary structure directly or by way of an intermediate silicone foam rubber pad. The use of foam rubber pads permits the use of buckling skins and protruding heat rivets on the primary structure, minimizing structural weight and fabrication costs. In the case of the RSI, the foam rubber pad serves as a required strain isolator. For purpose of comparison, test data were obtained for an installation with and without the use of a strain isolator. The refurbishment aspects of a bonded-on RSI concept (without a strain isolator) were examined experimentally along with several externally removable panel concepts employing both ablator and RSI TPS. The various concepts are compared.
Author

N72-27923*# Chrysler Corp., New Orleans, La.
INVESTIGATION OF PROPULSION PACKAGES FOR THE NASA/LaRC PARAMETRIC DELTA WING ORBITER
J. C. Ellison Jun. 1972 78 p
(Contract NAS8-4016)
(NASA-CR-123722; DMS-DR-1232) Avail: NTIS HC $6.00 CSCL 22B

A delta-wing orbiter model was tested in the unitary plan wind tunnel and the low turbulence pressure tunnel. Static longitudinal and lateral-directional aerodynamic characteristics were obtained at Mach numbers of 0.25, 1.50 and 2.16 with corresponding Reynolds numbers based on model length of 21.4, 3.81 and 5.16 million. Angle of attack was varied from -4 deg to 26 deg at 0 deg and 5 deg of sideslip. Model variables included three control engine systems. The total tunnel occupancy time for both tests was 88 hours.
Author

N72-27924*# Chrysler Corp., New Orleans, La.
SPACE SHUTTLE ABORT SEPARATION PRESSURE INVESTIGATION. VOLUME 1, PART A: BOOSTER DATA AT MACH 5
L. L. Trimmer (ARO, Inc.), D. A. Love (LMSC, Huntsville), J. M. Rampy (Northrop Services, Inc.), J. P. Decker (NASA. Langley Res. Center), K. L. Blackwell (NASA. Marshall Spaceflight Center), and W. T. Strike (ARO, Inc.) Jun. 1972 1119 p refs
(Contract NAS8-4016)
(NASA-CR-120008-VOL-1-PT-A; DMS-DR-1174-Vol-1-Pt-A) Avail: NTIS HC $57.95 CSCL 22B

Pressure data obtained from a joint Langley Research Center (LaRC)/Marshall Space Flight Center (MSFC) Space Shuttle about stage separation wind tunnel test are presented. The .00556 scale models of the McDonnell-Douglas orbiter and booster configurations were tested in proximity in Tunnel A of the Von Karman Facility (VKF), Arnold Engineering Development Center (AEDC). Mach numbers were 5.0, 3.0, and 2.0 and nominal Reynolds numbers were 1.09, 1.60, and 1.74 million per foot, respectively. Pressure data were obtained for the booster upper surface and orbiter lower surface at angles of attack of -10 deg, -5, 0, 5, and 10 deg for zero degrees sideslip. The models were tested at incidence angles of 0 and 5 deg for several separation distances and power conditions. Plug nozzles utilizing air were used to simulate booster and orbiter plumes at various altitudes along a nominal ascent trajectory. Powered conditions were 100, 50, and 0 percent of full power for the orbiter and 100, 50 and 0 percent of full power for the booster. Data were also obtained with the booster canard off in close proximity.
Author

N72-27925*# Chrysler Corp., New Orleans, La.
SPACE SHUTTLE ABORT SEPARATION PRESSURE INVESTIGATION. VOLUME 1, PART B: BOOSTER DATA AT MACH 5
L. L. Trimmer (ARO, Inc.), D. A. Love (LMSC, Huntsville), J. M. Rampy (Northrop Services, Inc.), J. P. Decker (NASA. Langley Res. Center), K. L. Blackwell (NASA. Marshall Spaceflight Center), and W. T. Strike (ARO, Inc.) Jun. 1972 632 p refs
(Contract NAS8-4016)
(NASA-CR-120008-VOL-1-PT-B; DMS-DR-1174-Vol-1-Pt-B) Avail: NTIS HC $33.75 CSCL 22B
For abstract, see N72-27924.

N72-27926*# Chrysler Corp., New Orleans, La.
SPACE SHUTTLE ABORT SEPARATION PRESSURE INVESTIGATION. VOLUME 2, PART B: ORBITER DATA AT MACH 5
L. L. Trimmer (ARO, Inc.), D. A. Love (LMSC, Huntsville), J. M. Rampy (Northrop Services, Inc.), J. P. Decker (NASA. Langley Res. Center), K. L. Blackwell (NASA. Marshall Spaceflight Center), and W. T. Strike (ARO, Inc.) Jun. 1972 558 p refs
(Contract NAS8-4016)
(NASA-CR-120061; DMS-DR-1174-Vol-2-Pt-B) Avail: NTIS HC $30.00 CSCL 22B
For abstract, see N72-27924.

N72-27927*# Chrysler Corp., New Orleans, La.
SPACE SHUTTLE ABORT SEPARATION PRESSURE INVESTIGATION. VOLUME 3: BOOSTER DATA AT MACH 3
L. L. Trimmer (ARO, Inc.), D. A. Love (LMSC, Huntsville), J. M. Rampy (Northrop Services, Inc.), J. P. Decker (NASA. Langley Res. Center), K. L. Blackwell (NASA. Marshall Spaceflight Center), and W. T. Strike (ARO, Inc.) Jun. 1972 681 p refs
(Contract NAS8-4016)
(NASA-CR-120062; DMS-DR-1174-Vol-3) Avail: NTIS HC $36.25 CSCL 22B
For abstract, see N72-27924.

N72-27928*# Chrysler Corp., New Orleans, La.
SPACE SHUTTLE ABORT SEPARATION PRESSURE INVESTIGATION. VOLUME 4: ORBITER DATA AT MACH 3
L. L. Trimmer (ARO, Inc.), D. A. Love (LMSC, Huntsville), J. M. Rampy (Northrop Services, Inc.), J. P. Decker (NASA. Langley Res. Center), K. L. Blackwell (NASA. Marshall Spaceflight Center), and W. T. Strike (ARO, Inc.) Jun. 1972 447 p refs
(Contract NAS8-4016)
(NASA-CR-120063; DMS-DR-1174-Vol-4) Avail: NTIS HC $24.50 CSCL 22B
For abstract, see N72-27924

N72-27929*# Chrysler Corp., New Orleans, La.
SPACE SHUTTLE ABORT SEPARATION PRESSURE INVESTIGATION. VOLUME 5: BOOSTER DATA AT MACH 2
L. L. Trimmer (ARO, Inc.), D. A. Love (LMSC, Huntsville), J. M. Rampy (Northrop Services, Inc.), J. P. Decker (NASA. Langley Res. Center), K. L. Blackwell (NASA. Marshall Spaceflight Center), and W. T. Strike (ARO, Inc.) Jun. 1972 977 p refs
(Contract NAS8-4016)
(NASA-CR-120064; DMS-DR-1174-Vol-5) Avail: NTIS HC $51.00 CSCL 22B
For abstract, see N72-27924.

N72-27930*# Chrysler Corp., New Orleans, La.
SPACE SHUTTLE ABORT SEPARATION PRESSURE INVESTIGATION. VOLUME 6: ORBITER DATA AT MACH 2
L. L. Trimmer (ARO, Inc.), D. A. Love (LMSC, Huntsville), J. M. Rampy (Northrop Services, Inc.), J. P. Decker (NASA. Langley

Res. Center), K. L. Blackwell (NASA. Marshall Spaceflight Center), and W. T. Strike (ARO, Inc.) Jun. 1972 642 p refs
(Contract NAS8-4016)
(NASA-CR-120065; DMS-DR-1174-Vol-6) Avail: NTIS HC $34.25 CSCL 22B

For abstract, see N72-27924.

N72-27931# National Aerospace Lab., Tokyo (Japan).
THREE DIMENSIONAL SUB-OPTIMAL EXPLICIT GUIDANCE FOR SPACE VEHICLES
Koji Otsubo 1972 14 p refs In JAPANESE; ENGLISH summary
(NAL-TR-258) Avail: NTIS HC $3.00

An approximate, three-dimensional optimal explicit guidance method for space vehicles is developed. Analytical optimum solutions for both pitch and yaw thrust angles under the condition of minimum fuel expenditure are derived from Pontryagin's Maximum Principle. Small modifications for both optimum pitch and yaw angles are considered in order to satisfy the final position condition. For the purpose of reducing the computation time, several assumptions are made such as: (1) thrust and mass flow rate are constant, (2) gravity acceleration vector can be treated as the average of its present and terminal values because of its small change in each guidance computation cycle, and (3) yaw dynamics can be treated separately from pitch dynamics because of its small influence on pitch dynamics.
Author

N72-27932# National Aerospace Lab., Tokyo (Japan).
FLIGHT CONTROL SYSTEM DESIGN FOR LAUNCH VEHICLES WITH LIQUID PROPELLANT
Hidehiko Mori and Hajime Koshiishi 1972 41 p refs In JAPANESE; ENGLISH summary
(NAL-TR-264) Avail: NTIS HC $4.25

An attempt was made to construct a model launch vehicle for geostationary satellites. A synthetic procedure and techniques of designing the flight control system for the boost stage of this class of vehicles, and the characteristics of the prototype of the modzl SS-3, are given. Data cover: (1) the derivation of relating equations, (2) the system characterization with the aid of trajectory simulations, (3) the computing methods for flexible vehicle stabilization, and (4) the methods for calculating loads on the vehicle by the effects of the wind. The computer programs for drawing Nyquist plot, Bode plot, and root locus of a high order system with multiple feedback loops were worked out and used for vehicle stabilization
Author

N72-27933*# Martin Marietta Corp., Denver, Colo.
SYSTEMS-LEVEL STUDY OF A NONSURVIVABLE JUPITER TURBOPAUSE PROBE. VOLUME 1: SUMMARY Final Report, 4 Jun. 1971 - 4 Mar. 1972
R. S. Wiltshire Jun. 1972 95 p refs 3 Vol.
(Contract NAS5-11445)
(NASA-CR-122436; MCR-72-91-Vol-1) Avail: NTIS HC $6.75 CSCL 22B

The design of a space probe to explore the atmosphere of the planet Jupiter is discussed. Five major areas were considered: (1) definition of science requirements, (2) mission evaluation, (3) definition of probe system, (4) definition of spacecraft support requirements, and (5) nonequilibrium flow field analysis for communications blackout evaluation. The overall mission and system design are emphasized. The integration of the various technologies into complete systems designs is described. Results showed that a nonsurvivable turbopause probe mission to Jupiter with adequate data return to meet the science objectives is feasible and practical.
Author

N72-27934*# Martin Marietta Corp., Denver, Colo.
SYSTEMS-LEVEL STUDY OF A NONSURVIVABLE JUPITER TURBOPAUSE PROBE. VOLUME 2: SUPPORTING TECHNICAL STUDIES Final Report, 4 Jun. 1971 - 4 Mar. 1972
R. S. Wiltshire Jun. 1972 539 p ref 3 Vol.
(Contract NAS5-11445)
(NASA-CR-122439; MCR-72-91-Vol-2) Avail: NTIS HC $29.00 CSCL 22B

For abstract, see N72-27933.

N72-27935*# Chrysler Corp., New Orleans, La.
HEAT TRANSFER DISTRIBUTIONS ON THE LMSC 040C AND 040A-L4 DELTA WING ORBITERS (M EQUALS 8)7
R. C. Baker (LMSC, Sunnyvale, Calif.), K. W. McGee (LMSC, Sunnyvale, Calif.), and H. D. Schultz (LMSC, Sunnyvale, Calif.) Jul. 1972 129 p refs
(Contract NAS8-4016)
(NASA-CR-120072; DMS-DR-1266) Avail: NTIS HC $8.50 CSCL 22B

The results of a wind tunnel investigation are presented for measuring aerodynamic heat transfer distributions on the 040C and 040A-L4 space shuttle orbiter configurations. Heat transfer rates were determined by the phase change coating technique, using 0.012-scale Stycast models coated with Tempilaq. Data were obtained at a nominal free stream Mach number of 8, Reynolds numbers from 1.0 to 3.8 million per foot, and angles of attack from 20 to 60 deg.
Author

N72-27936# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, FEBRUARY 1972
R. D. Eberst 7 Apr. 1972 23 p
(ROE-STS-123) Avail: NTIS HC $3.25

Stopwatch observations during February 1972 are listed in launch and time order for each satellite. Various subtotals are given.
ESRO

N72-27937# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, MARCH 1972
R. D. Eberst 28 Apr. 1972 29 p
(ROE-STS-124) Avail: NTIS HC $3.50

Stopwatch observations during March 1972 are listed in launch and time order for each satellite. Various subtotals are given.
ESRO

N72-27938# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LUNOKHOD: A NEW STEP IN SPACE EXPLORATION
27 Oct. 1971 16 p refs Transl. into ENGLISH from Izvestiya (USSR), 9 Feb. 1971 p 3
(AD-738683; FTD-HT-23-709-71) Avail: NTIS CSCL 22/1

The article discusses the design of the Soviet lunar vehicle, Lunokhod-1. The Lunokhod has two television systems for solving different problems. There is the slow-scan system and a system which gives a panoramic view of the area as well as pictures of the sky, sun, and earth for providing astro-orientation of the vehicle. A special heat-control system was developed for the vehicle. Passive and active heat-control methods help maintain the required temperature conditions. The power supply of the vehicle consists of a solar and chemical buffer battery.
Author (GRA)

N72-27939# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOVIET ROBOT ON THE SEA OF RAINS
26 Oct. 1971 16 p refs Transl. into ENGLISH from Pravda Ukrainy (USSR), 18 Nov. 1970 p 1
(AD-738681; FTD-HT-23-284-71) Avail: NTIS CSCL 22/1

The article is a discussion of Lunokhod-1 by way of a reply by the director in charge of development of the self-propelled chassis to questions of a Pravda correspondent. The director discusses the background and purpose of the lunar vehicle, how

it was built, why wheels were used, and the different problems encountered along the way. Many tests were carried out through the use of special vacuum chambers and appropriately designed laboratory stands. Tests were also performed on the ground in an area best simulating lunar soil. Author (GRA)

N72-27940# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.
TECHNIQUES FOR GENERATING A REAL WORLD EPHEMERIS Technical Report, 1 Jan. 1971 - 1 Jan. 1972
J. A. Person, R. W. Bruce, and R. C. Gore 1 Jul. 1971 114 p refs
(Contract F04701-71-C-0172)
(AD-739492; TR-0172(2311)-4; SAMSO-TR-71-237) Avail: NTIS CSCL 22/3

The report documents the procedure for generating a real world ephemeris tape to be used by The Aerospace Corporation and selected contractors in Phase 0 of the Autonomous Navigation System (ANS) contract. A real world geopotential model was developed by modifying a state-of-the-art reference geopotential, using Kaula's degree variances as a guide. To obtain real world atmosphere data, the acceleration profile experienced by the first in a recent series of low altitude satellites to have an on-board low-g accelerometer was suitably scaled. The resulting ephemeris is displayed and subjected to various consistency tests. Author (GRA)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N72-27941 National Lending Library for Science and Technology, Boston Spa (England).
THE 1,000-HOUR STRESS-RUPTURE STRENGTH AT 300-700 C AND THE OXIDATION MECHANISM OF BRAZED JOINTS IN HEAT-RESISTANT ALLOYS
J. Colbus 4 Apr. 1972 17 p refs Transl. into ENGLISH from Metallwiss. Technik (East Berlin), v. 25, 1971 p 1103-1109 In GERMAN and ENGLISH
(NLL-LTI-746-1165-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Stress-rupture tests on brazed joints of various materials at specified elevated temperatures are discussed. It was determined that the stress-rupture behavior of brazing alloys depends on the stability and distribution of the phases contained in the brazing alloys. The influence of oxidation of stress-rupture testing in brazed joints is described. It was determined that the effect of reduction in diameter of the specimen due to oxidation is of minor importance. Author

N72-27942 National Lending Library for Science and Technology, Boston Spa (England).
STRESS-RELAXATION TESTS ON S. G. IRON GGG-38/42
S. Riegger, O. Voehringer, and E. Macherauch 4 Apr. 1972 8 p refs Transl. into ENGLISH from Giessereiforschung (Duesseldorf), v. 23, 1971 p 89-91
(NLL-Trans-746-1168-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Stress-relaxation tests to study the plastic deformation processes occurring in a stressed material due to the effects of thermal energy are described. The test is designed to furnish information relating to the stability of stress states which are induced in a material within the limits of inherent deformability. Tests were conducted using samples of ferritic S.G. iron and the procedures for conducting the tests are described. The effective stress in the tensile specimen was measured for a constant overall strain as a function of time. Mathematical models and charts are included to depict the results obtained. Author

N72-27943 National Lending Library for Science and Technology, Boston Spa (England).
INVESTIGATIONS OF PLATES AND LARGE TUBES WITH THE BATTELLE DROP WEIGHT TEAR TEST
H. Hengstenberg and F. Henrichs 20 Apr. 1972 47 p refs Transl. into ENGLISH from Baender, Bleche, Rohre (Duesseldorf), v. 12, no. 5, May 1971 p 208-219
(NLL-T1512/ERS/72-(9022.305)) Avail: Natl. Lending Library, Boston Spa, Engl.: 5 NLL photocopy coupons

Test methods for brittle fracture and the preparation of test specimens are discussed. The specific tests investigated are: (1) notch impact bend, (2) Pellini and Robertson tests, and (3) drop-weight tear tests. The application of the drop-weight tear tests to the analysis of plates and large tubes is described. The test result is evaluated on the basis of the proportions of matt and brittle fracture constituents on the fractured face of the broken specimen. The test temperature at which the specimen shows 75 to 80 percent matt fracture is given as a parameter for the toughness of the material. Author

N72-27944 National Lending Library for Science and Technology, Boston Spa (England).
ON THE DEVELOPMENT OF AERODYNAMICALLY STABLE SUSPENSION BRIDGES
Fritz Leonhardt [1972] 47 p refs Transl. into ENGLISH from Bautechnik (West Germany), v. 10, 1968 p 325-336, 372-380
(NLL-M-22432-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 5 NLL photocopy coupons

Methods for improving the aerodynamic stability of suspension bridges are discussed. The subjects covered are: (1) state of knowledge on aerodynamic behavior of suspension bridges, (2) new methods to insure aerodynamic stability, (3) properties of monocable suspension bridges, (4) reduction of wind forces on pylons, and (5) structural aspects of large suspension bridges. It is concluded that wind flow against and around the bridge must be split by a flat wedge shaped edge of the roadway to prevent eddy formation and vertical component wind forces from acting on the bridge. Author

N72-27945*# Stanford Univ., Calif.
APPLICATIONS OF THE THEORY OF OPTIMAL CONTROL OF DISTRIBUTED-PARAMETER SYSTEMS TO STRUCTURAL OPTIMIZATION
Jean-Louis Pierre Armand Washington NASA Jun. 1972 154 p refs
(Grant NGL-05-020-243)
(NASA-CR-2044) Avail: NTIS HC $3.00 CSCL 20K

An extension of classical methods of optimal control theory for systems described by ordinary differential equations to distributed-parameter systems described by partial differential equations is presented. An application is given involving the minimum-mass design of a simply-supported shear plate with a fixed fundamental frequency of vibration. An optimal plate thickness distribution in analytical form is found. The case of a minimum-mass design of an elastic sandwich plate whose fundamental frequency of free vibration is fixed. Under the most general conditions, the optimization problem reduces to the solution of two simultaneous partial differential equations involving the optimal thickness distribution and the modal displacement. One equation is the uniform energy distribution expression which was found by Ashley and McIntosh for the optimal design of one-dimensional structures with frequency constraints, and by Prager and Taylor for various design criteria in one and two dimensions. The second equation requires dynamic equilibrium at the preassigned vibration frequency. Author

N72-27946*# National Aeronautics and Space Administration, Washington, D.C.
REPORT OF THE NASA AD HOC COMMITTEE ON FAILURE

OF HIGH STRENGTH STRUCTURAL MATERIALS
William F. Brown, Jr., ed. Apr. 1972 83 p refs
(NASA-TM-X-68850) Avail: NTIS HC $6.25 CSCL 20K

An analysis of structural failures that have occurred in NASA programs was conducted. Reports of 231 examples of structural failure were reviewed. Attempts were made to identify those factors which contributed to the failures, and recommendations were formulated for actions which would minimize their effects on future NASA programs. Two classes of factors were identified: (1) those associated with deficiencies in existing materials and structures technology and (2) those attributable to inadequate documentation or communication of that technology. Author

N72-27947*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANTI-BUCKLING FATIGUE TEST ASSEMBLY Patent Application
Fred F. Eichenbrenner and Leland A. Imig, inventors (to NASA) Filed 30 Mar. 1972 14 p
(NASA-Case-LAR-10426-1; US-Patent-Appl-SN-239575) Avail: NTIS HC $3.00 CSCL 20K

A fatigue test apparatus for subjecting a test specimen of metal to varying temperature conditions and which prevents the specimen from buckling when loaded in compression is described. Another feature of the apparatus is that the operator may visually observe the test portion of the specimen while the tests are being conducted. The specimen may also be subjected to tensile tests and suitable conduits are provided to direct a cooling fluid to the test portion of the specimen. NASA

N72-27948# National Aerospace Lab., Tokyo (Japan).
INVESTIGATION OF THE STRENGTH OF AXIAL-FLOW COMPRESSOR DISC. 1: ON THE DISC WITH MANY PIN HOLES
Katsutoshi Matsusue and Makoto Yonaiyama Feb. 1972 12 p refs In JAPANESE; ENGLISH summary
(NAL-TR-274) Avail: NTIS HC $3.00

The strength of a disc of an axial-flow compressor and stresses of holes of a circular disc with many pin holes are measured by the photoelastic method. The force equivalent to the centrifugal force on rotating is loaded statically on the pin holes. The maximum stress shows a relationship to the number of the pin holes and to the distance from the center to the outside circumference of the disc, but hardly any relationship to the radius of the pin hole. The maximum stress draws near to constant values as the distance of the center of the pin hole from the outside circumference increases. Author

N72-27949# National Aerospace Lab., Tokyo (Japan).
ON THE VIBRATION OF THREE-PARALLEL-BEAMS
Yoichi Hayashi and Tsuneo Tsuiji Feb. 1972 22 p refs In JAPANESE; ENGLISH summary
(NAL-TR-271) Avail: NTIS HC $3.25

The vibration analysis of three parallel beams of different rigidities is presented. The analysis is carried out by means of the Rayleigh-Ritz method with three approximated deflection functions. Three power series are used as the deflection function of each beam. Results of numerical examples agree reasonably well with those of experiments. A lower eigenvalue than that of single beam under free-free condition exists. Author

N72-27950# National Aerospace Lab., Tokyo (Japan).
STRESS AND STRAIN CONCENTRATION FACTORS OF STRIPS WITH A CENTRAL CIRCULAR HOLE IN LINEAR STRAIN-HARDENING MATERIALS
Yoshio Aoki, Makoto Kuramoto, Yoshito Kobayashi, and Takeshi Kunio Feb. 1972 12 p refs In JAPANESE; ENGLISH summary
(NAL-TR-279) Avail: NTIS HC $3.00

Stress and strain concentration factors under the static tensile load in elastoplastic region are discussed. The factors are measured by the photoelastic coating method. The specimens used are linear strain-hardening aluminum alloy strips with a central circular hole. Using glassy and rubbery epoxy resins as coating materials, strains are measured through all ranges small to large. The results of experiments show that the stress concentration factor forms a constant curve which is denoted by the geometry of the specimens. Author

N72-27951# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
AN ELLIPTICAL CRACK SUBJECTED TO AN IMPULSIVE LOAD APPLIED TO ITS BOUNDARY
M. Ziv Feb. 1972 20 p refs
(TAE-148) Avail: NTIS HC $3.00

A boundary value problem where a crack is subjected to an impulsive load is solved. The crack considered is an elliptic cylindrical cavity in an infinite solid. The applied load is an impulsive step function of the Heaviside type and is distributed uniformly over the entire cavity. The solid is made of an ideal elastic material. Critical values of the stress distribution are calculated by the characteristics method to determine the decay of the generated wave. Author

N72-27952# National Aerospace Lab., Tokyo (Japan).
A STRUCTURAL ANALYSIS OF CYLINDER-CONE-CYLINDER SHELLS BY THE FINITE ELEMENT METHOD
Akinori Ogawa 1972 19 p refs In JAPANESE; ENGLISH summary
(NAL-TR-262) Avail: NTIS HC $3.00

Various shell models composed of two cylindrical shells and a truncated conical shell are analyzed numerically by the finite element method. The cone angle is varied from 20 to 180 degrees and the joint curvature radius is varied from zero to maximum. High approximation function in plane displacement is used because of transverse load and of slope discontinuity at the joint circles. It is shown that the larger the cone angle, and the smaller the joint curvature, the weaker is the bending stiffness of the model. Author

N72-27953# National Aerospace Lab., Tokyo (Japan).
DYNAMIC STABILITY OF A CONNECTED ROD UNDER PERIODIC LONGITUDINAL FORCE
Masaaki Sano 1972 13 p refs In JAPANESE; ENGLISH summary
(NAL-TR-257) Avail: NTIS HC $3.00

The dynamic stability of rods, which are connected by a spring, under periodic longitudinal loading was investigated. The regions of dynamic stability were determined. The boundaries of the first and the fourth unstable regions, and the upper boundary of the second unstable region obtained by the tests agree well with the theory. No correlation was found between the third unstable region and the lower boundary of the second unstable region. The stiffness of the spring was found to have little influence on the boundaries of the unstable region under specified conditions of the excitation parameter used to plot the boundaries. Author

N72-27954# Toronto Univ. (Ontario). Dept. of Mechanical Engineering.
VIBRATION OF CYLINDRICAL SHELLS BY A HYBRID FINITE ELEMENT METHOD
B. Tabarrok and N. Gass 5 Jul. 1972 50 p refs Backup document for AIAA synoptic scheduled for publication in the AIAA Journal, December 1971. Sponsored in part by Def. Res. Board of Can.
Avail: NTIS HC $4.50

The application of a hybrid finite element method for analyzing the vibration characteristics of cylindrical shells is discussed. The hybrid formulation is based on a variational principle which is the generalization of the principle given for elastostatic problems by Pian. Formulas for the special case of harmonic vibrations with the frequency as the pertinent functional

over a given domain are presented. The following examples are included: (1) natural frequency of curved fan blade, (2) vibration properties of clamped cylindrical panel, and (3) vibration properties of complete cylinder freely supported at both ends. P.N.F.

N72-27955# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
CRACK PROPAGATION IN A FULL-SCALE WING STRUCTURE UNDER RANDOM FLIGHT-SIMULATION LOADING
J. Schijve and P. DeRijk Apr. 1971 54 p refs Sponsored by Neth. Aircraft Develop. Board (NIV)
(NLR-TR-71043-U) Avail: NTIS HC $4.75

Flight simulation tests carried out on a wing of the Fokker F-28 Fellowship under cyclic gust loading are reported on. Truncation of infrequently occurring high-amplitude gust cycles to a lower level considerably accelerated crack growth. A 25 percent increase of the design stress level induces about 2.5 times faster crack growth. The application of fail-safe loads (100 percent limit load) drastically delayed subsequent crack growth.
Author (ESRO)

N72-27956# Institut fuer Festkoerpermechanik, Freiburg (West Germany).
ON IMPROVING THE FRACTURE TOUGHNESS OF CERAMICS BY LIQUID ENVIRONMENTS
Donald A. Shockey and Siegfried R. Winkler Dec. 1971 43 p refs
(WB-5/71) Avail: NTIS HC $4.25

Four sets of experiments were carried out in an attempt to determine if plastic flow in ceramic materials can be influenced by the presence of certain liquids. Double cantilever beam specimens cleaved from single crystal stock of MgO and KCl were stressed by means of a tensile machine in air, water, and dimethyl formaldehyde, and the size of the plastic zone resulting from the stress concentration at the crack tip was used to study possible effects of these environments on dislocation mobility. The results are in agreement with the lubrication explanation. The capability of liquid environments in improving the fracture toughness of ceramics was evaluated for magnesium oxide by theoretical calculations and by fracture mechanics experiments. The results show that significant toughness increase due to the presence of liquids on ceramic surfaces is not to be expected.
ESRO

N72-27957# Brown Univ., Providence, R.I.
A CRACK EXTENDING NON-UNIFORMLY IN AN ELASTIC SOLID SUBJECTED TO GENERAL LOADING Technical Report, Jun. - Oct. 1971
L. B. Freund Dec. 1971 35 p refs
(Contract F33615-71-C-1308; AF Proj. 7353)
(AD-739557; AFML-TR-71-263) Avail: NTIS CSCL 20/11

The stress intensity factor of a half-plane crack extending non-uniformly in an isotropic elastic solid subjected to general loading is determined. The loading is applied in such a way that a state of plane strain exists, and that crack extension takes place in mode I. The crack tip is initially at rest, and then moves in an arbitrary way in the plane of the crack. In the process of obtaining the stress intensity factor, the complete elastic field is determined for a crack which starts from some initial position, extends at a constant rate for some time, and then suddenly stops. Once the stress intensity factor is known for arbitrary motion of the crack tip, the Griffith fracture criterion is applied to obtain an equation of motion for the crack tip which is consistent with the assumptions of this criterion. Numerical results are included for the stress intensity factor and for the velocity-dependent term in the equation motion. Author (GRA)

N72-27958# Massachusetts Univ., Amherst. Dept. of Civil Engineering.
RANDOM VIBRATION OF THIN ELASTIC PLATES AND SHALLOW SHELLS
Hidekichi Kanematsu and William A. Nash Jul. 1971 87 p refs
(Grant AF-AFOSR-1527-68; AF Proj. 9782)
(AD-739976; AFOSR-71-1860TR) Avail: NTIS CSCL 20/11

The large amplitude vibrations of thin elastic plates and shallow shells having boundary conditions and subjected to random excitation are investigated by using various approximate techniques. The random vibrations of rectangular plates and circular plates subjected to white random excitation are simulated numerically by two different methods. The first method is that the governing equations are reduced to a single-degree-of-freedom dynamical system and the reduced equation is then integrated numerically by the Runge-Kutta method employing the simulated approximate white noise as an input. The second method consists in integrating the equation of motion and the compatibility equation numerically by a finite-difference method employing the simulated approximate white noise as an input.
Author (GRA)

N72-27496 Gas Council, London (England).
RELEVANCE OF HEAT-AFFECTED ZONE TOUGHNESS TO MATERIAL SELECTION FOR PRESSURE VESSELS Conference Paper No.5
G. D. Fearnehough *In* Welding Inst. Improving Welded Prod. Design, Vol. 1 1971 p 35-44 refs (For availability see N72-27491 18-15)
Copyright.

N72-27500 Cambridge Univ. (England).
EFFECT OF WELDING ON COMPRESSION ELEMENTS Conference Paper No. 9
J. B. Dwight *In* Welding Inst. Improving Welded Prod. Design, Vol. 1 1971 p 73-84 refs (For availability see N72-27491 18-15)
Copyright.

N72-27501 Imperial Coll. of Science and Technology, London (England).
BASIS OF DESIGN FOR FILLET-WELDED JOINTS UNDER STATIC LOADING Conference Paper No. 10
P. J. Clark *In* Welding Inst. Improving Welded Prod. Design, Vol. 1 1971 p 85-96 refs (For availability see N72-27491 18-15)
Copyright.

N72-27510 Welding Inst., Cambridge (England).
OPTIMUM DETAIL DESIGN BASED UPON STRAIN MEASUREMENTS IN SERVICE Conference Paper No. 18
B. R. Piggott and C. C. Woodley *In its* Improving Welded Prod. Design, Vol. 1 1971 p 152-158 refs (For availability see N72-27491 18-15)
Copyright.

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N72-27959* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LINEAR EXPLOSIVE COMPARISON Patent
Laurence J. Bement, inventor (to NASA) Issued 17 Jun. 1971 7 p Filed 17 Jun. 1971 Supersedes N72-21955 (10 - 12, p 1682)

(NASA-Case-LAR-10800-1; US-Patent-3,670,559; US-Patent-Appl-SN-154094; US-Patent-Class-73-35) Avail: US Patent Office CSCL 19A

An apparatus for quantitatively determining the performance of linear explosives, mild detonating fuse, and flexible linear charges is described. Elongated explosive samples are detonated in a test fixture that is provided with means for sensing the explosive blast energy, explosive cutting ability, and detonation propagation rate. Official Gazette of the U.S. Patent Office

N72-27960 National Lending Library for Science and Technology, Boston Spa (England).

SOME CHARACTERISTICS OF LAMINAR DIFFUSION FLAMES

J. Vaerman 20 Apr. 1972 15 p refs Transl. into ENGLISH from Ind. Chim. Belge (Brussels), V. 32, 1967 p 653-657 In FRENCH and ENGLISH

(NLL-T-1530-(9022.305)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Confined laminar flames with emphasis on the parameters which determine the geometry of the flame and the emission of soot are discussed. For the hydrocarbon flames studied, the height of the flame is controlled by the flow-rate of the fuel and by the rate at which oxygen is entrained by diffusion. It has been possible to establish a simple model using a constant interdiffusion coefficient for all flame heights, and which is independent of the nature of the hydrocarbon. A study has been made of the smoke point. By altering the confinement of the flame and diluting the combustible with an inert gas, the emission of soot is modified without altering the geometrical characteristics of the flames. The influences of concentration, temperature, and residence time on the soot forming processes are determined. Author

N72-27961 National Lending Library for Science and Technology, Boston Spa (England).

THE DETONATION PROPERTIES OF SOME HETEROGENEOUS SYSTEMS

V. P. Komov and Ya. K. Troshin 20 Apr. 1972 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Fiz. Khim. (Moscow), v. 175, no. 1, 1967 p 109-112

(NLL-298-(8660.5)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The propagation of a detonation in pipes with heterogeneous systems consisting of a layer of liquid or solid fuel along the walls and a gaseous oxidizing agent in the space between is discussed. The principles of the detonation waves and their mechanism and structure are examined. The fuels used were liquid petroleum oils and highly viscous lubricating materials. The oxidizing agent was gaseous oxygen or air, enriched with oxygen, at an initial pressure of one to forty atmospheres. It was determined that some properties of detonations in heterogeneous systems are analogous to those of detonations in gas mixtures. Author

N72-27962 National Lending Library for Science and Technology, Boston Spa (England).

EMPIRICAL EQUATIONS FOR THE RELATIONSHIP OF THE THERMAL AND PHYSICAL PROPERTIES OF STEEL TO TEMPERATURE

V. A. Makovskii [1972] 9 p refs Transl. into ENGLISH from Stal (Moscow), no. 1, 1972 p 87-89

(NLL-M-21368-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Empirical equations have been proposed for calculating the heating and cooling of metal with electronic computers. These equations are for the relationship of the following thermal and physical properties of steel to temperature: the coefficient of thermal conductivity, the coefficient of linear expansion, and the true and mean heat capacities. The equations for carbon, low-alloy and chromium-nickel steels contain staged functions, the exponential function, and the hyperbolic cosine cosh. The mean error in approximating the thermal and physical properties of steel with the proposed equations does not exceed 5%. Author

N72-27963 National Lending Library for Science and Technology, Boston Spa (England).

GREEN FUNCTIONS IN THE SOLUTION OF THERMAL CONDUCTIVITY PROBLEMS FOR A HOLLOW CYLINDER

V. P. Merzlyakov 7 May 1972 5 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (Belorussia), v. 21, no. 6, Dec. 1971 p 1096-1100

(NLL-WH-Trans-325-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The application of Green functions in the solution of thermal conductivity problems for a hollow cylinder is described. Expressions are given for auxiliary functions enabling the convergence to be improved in many cases, especially for mixed boundary conditions with heat transfer at the external surface. Mathematical models for various types of boundary conditions are included to support the theoretical considerations. A table of values of roots of the transcendental equations derived by this method is included. P.N.F.

N72-27964*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.

EVALUATION OF ELECTROEXPLOSIVE DEVICES BY NONDESTRUCTIVE TEST TECHNIQUES AND IMPULSIVE WAVEFORM FIRINGS

V. J. Menichelli 15 Jun. 1972 25 p refs

(Contract NAS7-100)

(NASA-CR-127255; JPL-TR-32-1556) Avail: NTIS HC $3.25 CSCL 19A

Special requirements of the space industry for more detailed knowledge of the quality and reliability of each electroexplosive device (EED) selected for use aboard a spacecraft are described. Statistical methods do not practically demonstrate the high reliability needed. To close this gap, nondestructive test techniques and instrumentation for 1-W/1-A no-fire devices have been developed. Several lots of squibs have been evaluated using these techniques and instrumentation. They yield data as to the quality and normal behavior of each electroexplosive device without firing or degrading the unit. Performance data were obtained by initiating the EED's with an impulsive waveform and sensing the initiation characteristics, sensitivity, and output. Author

N72-27965*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

JOULE-THOMSON INVERSION CURVES AND RELATED COEFFICIENTS FOR SEVERAL SIMPLE FLUIDS

Robert C. Hendricks, Ildiko C. Peller, and Anne K. Baron Washington Jul. 1972 60 p refs

(NASA-TN-D-6807; E-6786) Avail: NTIS HC $3.00 CSCL 20M

The equations of state (PVT relations) for methane, oxygen, argon, carbon dioxide, carbon monoxide, neon, hydrogen, and helium were used to establish Joule-Thomson inversion curves for each fluid. The principle of corresponding states was applied to the inversion curves, and a generalized inversion curve for fluids with small acentric factors was developed. The quantum fluids (neon, hydrogen, and helium) were excluded from the generalization, but available data for the fluids xenon and krypton were included. The critical isenthalpic Joule-Thomson coefficient mu sub c was determined; and a simplified approximation mu sub c approximates T sub c divided by 6P sub c was found adequate, where T sub c and P sub c are the temperature and pressure at the thermodynamic critical point. The maximum inversion temperatures were obtained from the second virial coefficient (maximum (B/T)). Author

N72-27966*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AN ANALYTICAL AND EXPERIMENTAL EVALUATION OF SHADOW SHIELDS AND THEIR SUPPORT MEMBERS

Robert J. Stochl and Robert J. Boyle 1972 18 p refs Presented at Cryog. Eng. Conf., Boulder, Colo., 9-11 Aug. 1972

(NASA-TM-X-68099; E-7023) Avail: NTIS HC $3.00 CSCL

20M

Experimental tests were performed on a model shadow shield thermal protection system to examine the effect of certain configuration variables. The experimental results were used to verify the ability of an analytical program to predict the shadow shield performance including the shield-support interaction. In general, the analysis (assuming diffuse surfaces) agreed well with the experimental support temperature profiles. The agreement for the shield profiles was not as good. The results demonstrated: (1) shadow shields can be effective in reducing the heat transfer into cryogenic propellant tanks, and (2) the conductive heat transfer through supports can be reduced by selective surface coatings. Author

N72-27967# National Aerospace Lab., Amsterdam (Netherlands). Div. of Spaceflight Technology.

THERMAL CONDUCTIVITY OF HONEYCOMB SANDWICH PANELS FOR SPACE APPLICATIONS

J. F. Heemskerk, A. A. M. Delil, and D. H. W. Daniels 11 Mar. 1971 30 p refs

(NLR-TR-71031-U) Avail: NTIS HC $3.50

The thermal conductivity of a honeycomb sandwich panel for spacecraft structural application was measured in three characteristic directions in a vacuum space simulation chamber. Experimental methods were developed for determining the thermal conductivity of sandwich materials. The accuracy of thermal conductivity calculation for sandwich panels with known thermal properties is determined. The results are compared with those of a simplified model and show good agreement between values measured and those calculated. ESRO

N72-27968# Tennessee Univ., Tullahoma. Space Inst.

POLLUTANT PRODUCTION IN A SIMULATED TURBOJET AFTERBURNER. PART 1: EXPERIMENTAL AND THEORETICAL STUDY Final Report, 1 Nov. 1970 - 31 Jul. 1971

LLoyd W. Crawford, Arthur A. Mason, and James M. Lents Feb. 1972 140 p refs

(Contract F33615-71-C-1125; AF Proj. 3066)

(AD-739176; AFAPL-TR-71-66-Pt-1) Avail: NTIS CSCL 21/2

An experimental and theoretical study has been made of the history of the pollutants carbon monoxide (CO), unburned hydrocarbons (HC) and nitrogen oxides (NO(x)) in a turbojet afterburner. Experimental traverses at several axial stations were performed in a simulated afterburner in which exhaust from a J-47 combustor can, operated at medium power, was mixed with fuel spray. Experiments were carried out both in a non-bypass and in a bypass configuration (secondary air was mixed with primary exhaust). The theoretical analysis consisted of a computer program for reacting flow with turbulent mixing. Infrared measurements of NO in the combustion tunnel were attempted. Indications were obtained of NO at the 5.3 micron band, but quantitative measurements were not obtained.

Author (GRA)

N72-27969# Tennessee Univ., Tullahoma. Space Inst.

POLLUTANT PRODUCTION IN A SIMULATED TURBOJET AFTERBURNER. PART 2: COMPUTER PROGRAM FOR CALCULATION OF POLLUTANT HISTORY IN AFTERBURNING TURBOJET ENGINES Final Report, 1 Nov. 1970 - 31 Jul. 1971

LLoyd W. Crawford, Arthur A. Mason, and James M. Lents Feb. 1972 70 p refs

(Contract F33615-71-C-1125; AF Proj. 3066)

(AD-739177; AFAPL-TR-71-66-Pt-2) Avail: NTIS CSCL 21/2

The users manual was prepared to provide the means of estimating air pollution concentrations in the exhaust gases from afterburning turbojet engines. Author (GRA)

N72-27970# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE QUESTION OF BURNING IN TURBULENT FLOW

L. P. Yarin 15 Dec. 1971 8 p refs Transl. into ENGLISH from Probl. Teploenerg. Prikl. Teplofiz. (Alma-Ata), no. 5, 1969 p 180-182

(AD-739292; FTD-HT-23-1241-71) Avail: NTIS CSCL 21/2

An attempt is made to analyze qualitatively the different combustion diagrams of jets (in the development of discussions in the literature) on the effect of turbulent temperature pulsations on the combustion rate observed. Using ordinary terminology the author distinguishes three regions: the "kinetic" region for small pulsations corresponding to the volumetric model of turbulent combustion; the "intermediate" region in which the mixing characteristics and the total reaction rate are considerable; and the "diffusion" region for which turbulent pulsations play a considerable role. GRA

N72-27971# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

SUPERSONIC MIXING AND COMBUSTION OF COAXIAL HYDROGEN-AIR STREAMS IN A DUCT Final Report

James E. Drewry Dec. 1971 167 p refs

(AF Proj. 7065)

(AD-739866; ARL-71-0286) Avail: NTIS CSCL 21/2

A basic investigation of supersonic mixing and combustion which is relevant to advanced propulsion concepts for a high Mach number, high altitude flight regime is described. A method of laboratory simulation is employed which is considered to be suitable for fundamental studies of diffusional-controlled mixing and combustion of confined coaxial streams of hydrogen and air under conditions approaching those of actual flight. A unique test facility consisting of a gas-fired, ceramic-brick air storage heater and an electrical-resistance hydrogen heater was used to generate test flow conditions at low static pressures, over wide ranges of temperature and velocity. Research studies have been carried out to obtain basic flow field data pertinent to the problem of turbulent mixing and combustion of heterogeneous gas streams under these conditions. Auto-ignition data from tests involving sustained combustion at an air Mach number of 2.6 are also presented. Author (GRA)

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N72-27972*# National Aeronautics and Space Administration, Washington, D.C.

[BACKGROUND MATERIAL ON THE AGREEMENT SIGNED 24 MAY IN MOSCOW ON COOPERATION IN SPACE BETWEEN THE UNITED STATES AND THE SOVIET UNION News Release]

Richard T. Mittauer 24 May 1972 63 p refs

Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 05D

The text of the agreement between the United States and the Union of Soviet Socialist Republics on cooperation in space is presented. The treaty was signed in Moscow on 24 May, 1972. The treaty considers the cooperation in the exploration and use of outer space for peaceful purposes. The intent of the treaty is to obtain further expansion of the cooperation between the United States and the U.S.S.R. for spacecraft design, compatible equipment, and planning of concurrent space missions with eventual link-up of American and Russian space vehicles.

P.N.F.

N72-27973# Committee on Appropriations (U. S. Senate).

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT; SPACE, SCIENCE, VETERANS, AND CERTAIN OTHER INDEPENDENT AGENCIES APPROPRIATION BILL,

1973
Pastore Washington GPO 31 May 1972 48 p refs Rept. to accompany H.R. 15093 presented by the Comm. on Appropriations at the 92d Congr., 2d Sess., 31 May 1972
(S-Rept-92-820) Avail: US Capitol, Senate Document Room

Congressional action on the requests for fiscal year 1973 funds submitted by various federal agencies is reported. The agencies for which the funds were appropriated are: (1) Department of Housing and Urban Development, (2) NASA, (3) National Science Foundation, (4) Veterans Administration, and (5) several independent boards and commissions. A comparative statement for the budget for FY 1972 and FY 1973 is included.
P.N.F.

N72-27974# Committee on Appropriations (U. S. House).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT; SPACE, SCIENCE, VETERANS, AND CERTAIN OTHER INDEPENDENT AGENCIES APPROPRIATION BILL, 1973
Boland Washington GPO 18 May 1972 41 p refs Rept. to accompany H.R. 15093 presented by the Comm. on Appropriations at the 92d Congr., 2d Sess., 18 May 1972
(H-Rept-92-1071) Avail: US Capitol, House Document Room

A Congressional hearing concerning appropriations for various federal agencies is presented. The agencies represented in the report are: (1) Department of Housing and Urban Development, (2) NASA, (3) National Science Foundation, (4) Veterans Administration, and (5) several independent executive agencies, boards, commissions, and offices. The appropriations are designated for the fiscal year ending June 30, 1973. The justification for allocating specific funds and the proposed use of the funds are described.
P.N.F.

N72-27975# National Bureau of Standards, Washington, D.C.
REPORT OF THE 56TH NATIONAL CONFERENCE ON WEIGHTS AND MEASURES 1971
Frances C. Bell, ed. and Harold F. Wollin, ed. Mar. 1972 252 p refs Conf. held at Washington, D. C.; sponsored by NBS
(NBS-SP-358; LC-26-27766) Avail: SOD $1.50 as C13.6/3:358

The proceedings of the Fifty-sixth National Conference on Weights and Measures are presented. The conference was sponsored by the National Bureau of Standards and was held in Washington, D.C. in July 1971. Papers were presented on the following subjects: (1) management of a weights and measures program, (2) accreditation of weights and measures jurisdictions, (3) measurement in a changing world of technology, (4) unit pricing, (5) textile package labeling, and (6) flow measurement of cryogenic fluids.
P.N.F.

N72-27976# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL PROGRAM, 1973
May 1972 28 p
(AGARD-Bull-72-2) Avail: NTIS HC $3.50

The technical program of the Advisory Group for Aerospace Research and Development (AGARD) for 1973 is presented. The subjects sponsored by the panels are presented and the budgetary requirements for publishing panel reports are submitted. The AGARD panels cover the following subjects: (1) aerospace medicine, (2) avionics, (3) flight mechanics, (4) fluid dynamics, (5) guidance and control, (6) propulsion, and (7) structures and materials.
P.N.F.

N72-27977# Committee on Appropriations (U. S. Senate).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, SPACE, SCIENCE, VETERANS, AND CERTAIN OTHER INDEPENDENT AGENCIES APPROPRIATIONS FOR FISCAL YEAR 1973
Washington GPO 1972 953 p refs Hearings on H. R. 15093 before Comm. on Appropriations, 92d Congr., 2d Sess., 11-13, 18-20, and 25-27 Apr. 1972
Avail: Subcomm. of the Comm. on Appropriations

Congressional hearings before the Subcommittee of the Appropriations Committee of the United States Senate to determine fiscal year 1973 budget actions are presented. The funds under consideration were requested by: (1) Department of Housing and Urban Development, (2) NASA, (3) National Science Foundation, (4) Veterans Administration, and (5) several independent governmental agencies. The programs for which funds are requested are described by witnesses to justify the amounts of funds. Tables and charts are included to substantiate the funding requests.
P.N.F.

N72-27978# National Science Foundation, Washington, D.C.
FEDERAL FUNDS FOR ACADEMIC SCIENCE, FISCAL YEAR 1970
Dec. 1971 72 p
(NSF-72-301) Avail: SOD $0.70

Statistical analyses of Federal obligations awarded to universities and colleges for academic science activities for fiscal year 1970 are presented. Funding patterns are examined in terms of specific types of science activities, fields of science, agency sources of support, and geographic and institutional distribution of funds. The source of the information is the Government-wide data system established for the purpose of making available to science policy makers comprehensive information on federally funded science activities at universities and colleges.
Author

N72-27979# National Center for Atmospheric Research, Boulder, Colo.
NCAR RESEARCH AND FACILITIES PROGRAMS Annual Report, 1971
May 1972 185 p refs Sponsored by NSF
(AR-10) Avail: NTIS HC $11.25

The activities of the National Center for Atmospheric Research (NCAR) during 1971 are described. During 1971 NCAR continued its commitments to large, multiorganizational projects, such as the Global Atmospheric Research Program and the National Hail Research Experiment. In addition, steps to begin participation with the Environmental Protection Agency and other groups in a joint program of atmospheric sampling in and near an urban area, St. Louis, Missouri, in support of pollution studies were taken. Plans to participate in a joint program of stratospheric aerosol and gas sampling and related studies were also formulated. An essential element of the broad program of NCAR is the many and varied interactions with scientists from other institutions. NCAR's programs of visiting appointments, professor adjoint arrangements with universities, seminars and conferences, graduate student visitors and summer colloquia, and joint or university use of NCAR facilities were all vigorously maintained during 1971. The sizes and variety of these programs range from small and simple - a single visit to NCAR by an individual from a university - to large and complex - the 1971 field trial of the National Hail Research Experiment.
Author

N72-27980# National Archives and Records Service, Washington, D.C.
INTO THE NEW REALM: A DOCUMENTARY HISTORY OF AMERICA'S VENTURE INTO SPACE
1970 41 p refs
(Publ-70-10) Avail: National Archives, Washington, D. C. 20408 $0.75

Historical documentation of man's venture from aerial exploration to space exploration is presented. Data cover kite, balloon, early aircraft, and rocket flights. Summaries are also given of propulsion methods, methods for reaching extreme altitudes, NASA budgets, and various proposals, presidential messages and bills concerning aerospace exploration.
E.H.W.

N72-27981# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON EASTERN EUROPE - SCIENTIFIC AFFAIRS, NO. 254

5 Jul. 1972 70 p refs Transl. into ENGLISH from Eastern European reports
(JPRS-56426) Avail: NTIS HC $5.50

Forest density in Romania was determined from aerial photographs and the results were compared to ground-based measurements with a Moosehorn instrument based on punctiform sampling. The black and white photographs were taken on panchromatic film scales between 1:9000 and 1:12,000. The interpretation conditions involved contact copy photograms and mirror stereoscopes. It is felt that good density measurements were obtained. Efforts to protect Yugoslavian farm crops against hail are briefly described and include a proposal to use rockets. A long-range Hungarian research plan, influenza epidemic migration in West Germany, and other scientific and technical research are also reported. N.E.N.

N72-27982# Defence Research Establishment Valcartier (Quebec).
DEFENSE RESEARCH AND DEVELOPMENT
1971 115 p refs In FRENCH and ENGLISH Original contains color illustrations
(DREV-666/72) Avail: NTIS HC $7.75

The establishment's purpose is to contribute to Canadian defense through a program of scientific analysis, evaluation, research and development and to provide technical assistance and advice to the Canadian Forces. The current program, places emphasis on lasers, surveillance, armaments, materials and weapon analysis. Author

N72-27983# RAND Corp., Santa Monica, Calif.
US TECHNOLOGY: DECLINE OR REBIRTH?
B. W. Augenstein Apr. 1972 17 p
(P-4806) Avail: NTIS HC $3.00

An analysis of the condition of technology in the United States at the present time is presented. It is concluded that there is a relative stagnation in both the service and manufacturing industries, but no single cause for this stagnation can be determined. Suggestions for generating new initiatives in the service industry in order to overcome the stagnation are submitted. Various applications of computer technology are proposed as a means to improve technology. The role of government in supporting research and development activities is discussed. P.N.F.

N72-27984# RAND Corp., Santa Monica, Calif.
CHOICE AMONG STRATEGIES FOR SYSTEM ACQUISITION
Alvin J. Hartman Mar. 1972 24 p refs Presented at Winter Meetings of the Econometric Soc., New Orleans, 27-29 Dec. 1971
(P-4794) Avail: NTIS HC $3.25

A model capturing the dimensions of and controls over an acquisition program is developed and analyzed. The model includes various dimensions of program performance, not only system performance and program schedule but also development and system cost as well as acquisition strategies, comprised of combinations of: (1) study, test, and demonstration activities: (2) contractor environments and contract types; and (3) sets of decision points for program, technological, or threat reassessment. Choice among strategies can be determined within a budget constraint by the utility of performance dimensions actually achieved to counter threats that actually materialize. The empirical results concentrate on determination of the technological advancement of a system and on investigation of the extent to which program performance flexibility is constrained by the acquisition strategy selected. Author

N72-27985*# Public Technology, Inc., Washington, D.C.
TECHNOLOGY FOR THE CITIES Annual Report
1971 49 p
(Contract NASw-2170)
(NASA-CR-127417; AR-1) Avail: NTIS HC $4.50 CSCL 05H

The activities of an organization for making the technology derived from NASA programs available for use by urban communities are discussed. Examples of technology utilization accomplished by the organization are: (1) self-contained breathing apparatus for firemen, (2) short range communication systems, (3) pavement marking, (4) protective clothing for firemen, (5) underground pipe and conduit locator, and (6) automatic fire hose flow regulator. The manner in which urban problems are identified and the designation of applicable technical developments are described. P.N.F.

N72-27986*# National Academy of Public Administration, Washington, D.C.
TRANSFORMATION OF SCIENTISTS AND ENGINEERS INTO MANAGERS
James A. Bayton and Richard L. Chapman 1972 135 p refs
(Contract NSR-09-046-001)
(NASA-SP-291) Avail: NTIS; SOD $1.50 CSCL 05I

The purposes of this research were to determine the principal problems and obstacles faced by specialists during the transition period when they are becoming managers, and to discover ways by which their difficulties might be avoided or overcome. It was found that senior management officials are unaware--or tend to ignore the importance--of the transition process and its problems, that little attention has been given to developing management training to overcome transition problems, and that much of the training which is offered is largely irrelevant to these problems. Author

N72-27987# George Washington Univ., Washington, D.C. School of Government and Business Administration.
IMPROVING COST ESTIMATING AND ANALYSIS IN DOD AND NASA Ph.D. Thesis
Bruce N. Baker Jan. 1972 196 p refs Sponsored in part by the Army
(AD-738983) Avail: NTIS CSCL 05/1

The procurement research was based on the assumption that one of the principal keys to improving the process is understanding how original government cost estimates are produced. This is the point where fact and fiction must be separated in time to affect the decision-making process. The research questions were oriented to examine the current approaches, attitudes, and preferences of managers and practitioners of cost estimating and cost analysis within the Department of Defense (DOD) and the National Aeronautics and Space Administration (NASA). GRA

N72-27988# Army Foreign Science and Technology Center, Charlottesville, Va.
ANTIAIRCRAFT DEFENSE HERALD, NUMBER 8, AUGUST 1971
3 Jan. 1972 176 p refs Transl. into ENGLISH of Vestn. Protivovozdushnoy Oborony (Moscow), no. 8, Aug. 1971
(AD-739229; FSTC-HT-23-1238-72; ACSI-K-0856) Avail: NTIS CSCL 15/3

Articles are presented on a new five year plan, group cohesion, interceptors, all-weather operations, flight safety, scientific and technical personnel, decision making, combat training, human engineering, test methods, electronic equipment, teaching aids, and guidance. GRA

N72-27989# Army Missile Command, Redstone Arsenal, Ala.
MISSILE SYSTEM COATING
James L. Gossett Jan. 1972 33 p refs
(AD-739504) Avail: NTIS CSCL 16/4

Life cycle costs involving Army personnel management, appropriations for the work breakdown structure of MIL STD 881 are identified to the cost categories of AR 37-18 covering weapon system research and development. Estimated ranges for cost elements provide visibility as to dollar value sensitivity. Author (GRA)

N72-27990# Army Foreign Science and Technology Center, Charlottesville, Va.
ANTIAIRCRAFT DEFENSE HERALD, NUMBER 7, JULY 1971
3 Jan. 1972 192 p refs Transl. into ENGLISH from Vestn. Protivovozdushnoi Oborony (Moscow), no. 7, 1971
(AD-739973; FSTC-HT-23-1240-72) Avail: NTIS CSCL 15/3
Contents: Military training; Aircraft stability; Psychometrics; Combat machinery life; Targets; Radar and radio; Photographing; Airfield maintenance. GRA

N72-27991# Army Foreign Science and Technology Center, Charlottesville, Va.
ANTIAIRCRAFT DEFENSE HERALD, NUMBER 10, OCTOBER 1971
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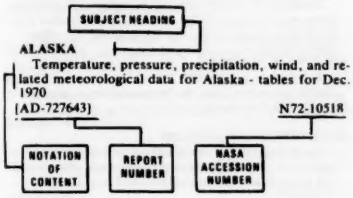
SUBJECT INDEX

TYPICAL SUBJECT INDEX LISTING



The subject heading is a key to the subject content of the document. The Notation of Content (NOC), rather than the title of the document, is used to provide a more exact description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The NASA accession number denotes the number by which the citation is identified. The NOC's are arranged under each subject heading in ascending accession number order.

A

A-4 AIRCRAFT
Development, stress analysis, and manufacturing of horizontal stabilizer for A-4 aircraft using graphite-epoxy laminates in primary structure
[AD-738900] N72-27040

ABERRATION
Computation of aberrations of concave grating and optimization of resolution by masking grating parts
N72-27450
Performance characteristics of Kerber plate applied to spherical aberration correction of Schmidt astronomical telescope mirror
N72-27453

ABLATION
Labor costs and techniques for maintenance of thermal protection system for space shuttle applications
[NASA-CR-112034-1] N72-27922

ABORT TRAJECTORIES
Wind tunnel tests to determine pressure distribution of space shuttle abort stage under various conditions of Mach number, Reynolds number, and angles of attack - Vol. 1, Pt. A
[NASA-CR-120008-VOL-1-PT-A]
N72-27924
Wind tunnel tests to determine pressure distribution on space shuttle scale model in abort mode configuration under various aerodynamic conditions -Vol. 1 Pt. B
[NASA-CR-120008-VOL-1-PT-B]
N72-27925
Wind tunnel tests to determine abort separation pressures on space shuttle orbiter at Mach 5 - Vol. 2 Pt B
[NASA-CR-120061] N72-27926
Wind tunnel tests to determine pressure distribution on space shuttle booster in abort configuration at Mach 3 - Vol. 3
[NASA-CR-120062] N72-27927
Wind tunnel tests to determine pressure distribution on space shuttle orbiter in abort configuration at Mach 3 - Vol. 4
[NASA-CR-120063] N72-27928
Wind tunnel tests to determine pressure distribution on space shuttle booster in abort configuration at Mach 2 - Vol. 5
[NASA-CR-120064] N72-27929
Wind tunnel tests to determine pressure distribution on space shuttle orbiter in abort configuration at Mach 2 - Vol. 6
[NASA-CR-120065] N72-27930

ABRASION
Correlation of abrasion, microindentation hardness and maximum fracture velocity of optical glasses in liquids
[WB-2/71] N72-27603

ABRASION RESISTANCE
Effects of hardness and microstructure of carbides of transition metals on abrasive wear resistance properties
[NLL-RTS-7289] N72-27513

ABSORPTION SPECTRA
Method for determining gas temperature profile and decay, using temperature dependence of line absorption
[AD-739491] N72-27783

ABUNDANCE
Fe-group abundance in energetic solar particles measured by Nike-Apache payloads on 24 Jan. and 2 Sept. 1971 and 2 Sept. 1966
[NASA-TM-X-65919] N72-27833

ACCELERATED LIFE TESTS
Accelerated life tests to determine effects of arrested landing stresses on C-2 aircraft structure
[AD-739331] N72-27036

ACCELERATION (PHYSICS)
Comparing effects of positive Gy acceleration on cardiovascular and respiratory functions in dogs under normal respiration in air, and when totally immersed in oxygenated fluorocarbon
[NASA-CR-127262] N72-27078
Alpha-beta method of linear prediction by radar tracking of flying target, taking into account maximum acceleration
[REPT-154] N72-27182
Device for applying simulated g-forces to arm of aircraft simulator pilot
[NASA-CASE-LAR-10550-1] N72-27271

ACCELERATION TOLERANCE
Physical models for visual - vestibular interactions in simulating human nystagmic eye movements
[AD-737795] N72-27090
Vestibular-ocular counterroll reflex for determining vestibular response dynamics of monkeys to acceleration
[AD-737828] N72-27094
Low cost telemetry subcarrier oscillator for high acceleration applications
[AD-739481] N72-27194

ACCELERATORS
Reduction of accelerator grid erosion due to direct impingement of ion beam
[NASA-TM-X-68096] N72-27824

ACCELEROMETERS
Triaxial piezoelectric accelerometer with sensitivity to extend upper limit of falling sphere type of upper atmospheric density measuring system
[AD-739202] N72-27473
Deployment of vertical and horizontal broadband accelerometers to obtain seismic wave data
[AD-739975] N72-27481
Finding meridian for base stationary relative to earth using angular accelerometer
N72-27698

ACOUSTIC EXCITATION
Acoustic vibratory response of structural OGO model enclosed in shroud and without shroud
[NASA-TM-X-65921] N72-27735

ACOUSTIC MEASUREMENTS
Analysis of noise generated by target type thrust reversers used on augmentor-wing short takeoff aircraft
[NASA-TM-X-68082] N72-27012
Acoustic measurement tests to determine reduction of aerodynamic noise by engine-over-wing concept for conventional and STOL aircraft
[NASA-TM-X-68104] N72-27030
Measurement of aircraft noise generated by YOV-10A short takeoff aircraft and comparison with wind tunnel data
[NASA-TM-X-62166] N72-27031
Tracking thrust-maneuvering space vehicle based on noise measurement
N72-27844

ACOUSTIC PROPAGATION
Response of shroud-enclosed spacecraft to combined acoustic-vacuum environments
[NASA-TM-X-65922] N72-27734

ACOUSTIC SCATTERING
Acoustic reflection profiles from ocean bottom east of Yucatan Peninsula
[PB-207595] N72-27390
Subbottom acoustic reflection profiles for Bay of Campeche in Gulf of Mexico
[PB-207594] N72-27391
Subbottom acoustic reflection from continental shelf off Venezuela
[PB-207597] N72-27392

ACOUSTIC VELOCITY
Temperature dependence of speed of sound and crystal structure of molten metals
[NLL-M-21371-[5828.4F]] N72-27788

ACOUSTICS
Ion acoustic solitary waves and shocks in two-component argon plasma
[NASA-CR-127387] N72-27770

ACTINOMETERS
Use of actinometric instruments for atmospheric radiation measurements
[TT-70-50159] N72-27663

ACTUATOR DISKS
Cryogenic gyroscope housing with annular disks for gas spin-up
[NASA-CASE-MFS-21136-1] N72-27731

ADAPTIVE CONTROL
Disturbance absorbing controllers for servomechanism problems
[AD-739503] N72-27260
Parameter identification for dynamic adaptive control
[AD-739525] N72-27627

ADHESION
Auger spectroscopy for detecting polytetrafluoroethylene adhesion on metal surfaces in ultrahigh vacuum
[NASA-TM-X-68076] N72-27150

ADJUSTING
Adjustable support device with jacket screw for altering distance between base and supported member
[NASA-CASE-NPO-10721] N72-27484

ADSORPTION
Anion effect in hydrogen adsorption on platinum electrode
[NASA-TT-F-14361] N72-27152
Increased resistivity of thin metallic films caused by gas adsorption
[NLL-TRANS-746-1194-[9022.401]]
N72-27789

AERIAL PHOTOGRAPHY
Forest density determined from aerial photographs, protection of farm crops against hail, and other scientific and technical research in Eastern Europe
[JPRS-56426] N72-27981

AERIAL RECONNAISSANCE
Airborne gamma surveys for determining water equivalent of snow cover
[TT-70-50093] N72-27662

AERODYNAMIC CHARACTERISTICS
Compilation of technical reports on theoretical aerodynamics and air flow - Vol. 1
[SBN-11-470151-2] N72-26993
Compilation of technical reports on theoretical aerodynamics, aircraft performance, sonic booms, aircraft stability, and turbulent boundary layers - Vol. 2
[SBN-11-470152-0] N72-26994
Jet effects on boattail drag of nozzles with truncated conical bodies at supersonic speed and varying ratios of boattail length to maximum diameter
[NASA-TN-D-6789] N72-26997
Pressure distribution and shear effect on blunt bodies produced by bow shock wave under supersonic speed conditions
[NAL-TR-266] N72-26998
Numerical analysis of response of spherical balloon to atmospheric turbulence and three-dimensional time-dependent flows
[NASA-TN-D-6829] N72-27001
Performance tests to determine problems associated with hovering, vertical takeoff, and landing of VTOL aircraft with emphasis on attitude control
[NAL-TR-276] N72-27027
Measurement of aerodynamic damping moment in pitch for hovering model helicopter rotary wing
[NAL-TR-256] N72-27028
Wind tunnel tests to determine opening dynamics of parachutes inflating under finite mass conditions using solid flat and ringslot configurations
[AD-739554] N72-27046

Determination of upwash angles for short takeoff aircraft lifting system using two dimensional potential flow analysis
[NASA-TM-X-2593] N72-27817

AERODYNAMIC COEFFICIENTS
Modulated force probe for drag coefficient measurements of spheres in hypersonic noncontinuum flow
[AD-739250] N72-27327
Empirical formulas for aerodynamic coefficients of blunted cones in rarefied gas
[AD-739214] N72-27331

AERODYNAMIC CONFIGURATIONS
Application of unconventional wing pivoting about spanwise axis forward of aerodynamic center for gust alleviation in general aviation aircraft
[NASA-CR-2046] N72-26996
Pressure distribution and shear effect on blunt bodies produced by bow shock wave under supersonic speed conditions
[NAL-TR-266] N72-26998
Change of shape in reentry bodies due to thermodynamic forces generated by high velocity movement in earth atmosphere
[JPRS-56424] N72-27003
Design and development of spin-recovery parachute systems for military aircraft and compilation of design criteria
[NASA-TN-D-6866] N72-27033
Characteristics of elliptically shaped leading edges of wings and fins for reduction of aerodynamic heating of reentry vehicles under hypervelocity flight conditions
[AD-739869] N72-27051

AERODYNAMIC DRAG
Computer program for coordinates, incompressible inviscid section characteristics, and two dimensional drag-rise for NACA airfoils
[AD-738623] N72-27332
Resistance of pyramidal shaped bodies in supersonic flow
[AD-739293] N72-27333

AERODYNAMIC FORCES
Aerodynamic interference between wing and surface of velocity discontinuity in nonuniform potential flow field
[NAL-TR-254] N72-27000
Development of algorithm based on matrix methods for solution of wind tunnel force-balance equations and iterative solution using automatic computer reduction
[NASA-TN-D-6860] N72-27002

AERODYNAMIC HEATING
Characteristics of elliptically shaped leading edges of wings and fins for reduction of aerodynamic heating of reentry vehicles under hypervelocity flight conditions
[AD-739869] N72-27051

AERODYNAMIC LOADS
Analysis of flight loads imposed on H-2 helicopter during fleet operations
[AD-738452] N72-27038

AERODYNAMIC NOISE
Analysis of noise generated by target type thrust reversers used on augmentor-wing short takeoff aircraft
[NASA-TM-X-68082] N72-27012
Analysis of peak axial-velocity decay in moving airstream for several nozzles and effect on noise generated by short takeoff aircraft with externally blown flaps
[NASA-TM-X-68102] N72-27029
Acoustic measurement tests to determine reduction of aerodynamic noise by engine-over-wing concept for conventional and STOL aircraft
[NASA-TM-X-68104] N72-27030

AERODYNAMIC STABILITY
Evaluation of dynamic stability of projectiles based on pitch damping moment transverse radius of gyration, and Magnus moment
[AD-738016] N72-27005
Wind tunnel tests to determine static longitudinal and lateral-directional aerodynamic effects of various configuration changes on parametric delta wing orbiter
[NASA-CR-123722] N72-27923

AERODYNAMIC STALLING
Inlet random pressure fluctuation effects on turbojet engine stall characteristics
N72-27022

AERONAUTICAL ENGINEERING
Aeronautical history leading to American space exploration
[PUBL-70-10] N72-27980

AEROSOLS
Methods, procedures, and equipment for isolation of submicron particles from agglomerate matrix
[AD-739197] N72-27162

AEROSPACE ENVIRONMENTS
Degradation of optical materials in aerospace environments noting point defects induced by ionizing radiation or charged particle collision
N72-27455
Advanced methods of reliability engineering and quality assurance for aerospace application
[NASA-TM-X-64666] N72-27516
Flowmeter and leak detector for gaseous flow detection in space environments
N72-27519
Quality and reliability requirements for hybrid microcircuits in space flight applications
N72-27520

AEROSPACE INDUSTRY
Nickel cadmium batteries for aerospace application including separators and seals, and cell performance and specification experience - 1971 NASA/Goddard-Aerospace Industry Battery Workshop
[NASA-TM-X-68828] N72-27061
Nickel cadmium batteries for aerospace application including materials, pre-charge, and thermal problems - 1971 NASA/Goddard-Aerospace Industry Battery Workshop
[NASA-TM-X-68829] N72-27062

AEROSPACE MEDICINE
Annotated bibliography and indexes on Aerospace Medicine and Biology - May 1972
[NASA-SP-7011[102]] N72-27076
Noise environment of C-7A during ground and airborne operation
[AD-738627] N72-27086

AEROSPACE SCIENCES
Schedule of meetings and lectures for 1973 technical program of Advisory Group for Aerospace Research and Development
[AGARD-BULL-72-2] N72-27976

AEROTHERMODYNAMICS
Change of shape in reentry bodies due to thermodynamic forces generated by high velocity movement in earth atmosphere
[JPRS-56424] N72-27003

AFTERBURNING
Afterburning steady state performance and operational limits of TF-30 turbofan engine
[NASA-TN-D-6839] N72-27014
Analysis of carbon monoxide, unburned hydrocarbons, and nitrogen oxides in turbojet afterburner combustion products using infrared spectroscopy - Part 1
[AD-739176] N72-27968
Computer program for determining history of combustion products produced by turbojet engine afterburner - Part 2
[AD-739177] N72-27969

AGRICULTURE
Operational application of computerized systems to agrometeorology
[NLL-M-22337-[5828.4F]] N72-27631

AIR COOLING
Flow characteristics of turbine airfoil cooling system components
[NASA-CR-120883] N72-27290

AIR FILTERS
Collection apparatus for sampling of small solid particles from atmosphere
[NASA-CASE-HQN-10037-1] N72-27424

AIR FLOW
Compilation of technical reports on theoretical aerodynamics and air flow - Vol. 1
[SBN-11-470151-2] N72-26993
Compilation of technical reports on theoretical aerodynamics, aircraft performance, sonic booms, aircraft stability, and turbulent boundary layers - Vol. 2
[SBN-11-470152-0] N72-26994
Application of streamline curvature method for determining performance of turbofans and comparison with empirical results
[NAL-TR-268T] N72-26999
Analysis of peak axial-velocity decay in moving airstream for several nozzles and effect on noise generated by short takeoff aircraft with externally blown flaps
[NASA-TM-X-68102] N72-27029
Extent of transition zone and heat transfer during mixed flow of air in pipes
[AD-739210] N72-27328
Determination of upwash angles for short takeoff aircraft lifting system using two dimensional potential flow analysis
[NASA-TM-X-2593] N72-27817

AIR LOCKS
Portable air supply and monitoring system for personnel working on offshore platform piling
N72-27123

AIR NAVIGATION
Characteristics of air navigation systems and methods for improving accuracy of navigation instruments and systems
[JPRS-56487] N72-27704

AIR POLLUTION
Environmental impact statement for Earth Resources Aircraft program
[NASA-TM-X-68550] N72-27008
Annotated bibliography of remote sensing of air and water pollution for 1965 through 1970
[AD-737588] N72-27406
Ethylene chemiluminescence ozone detector for smog chamber studies
[BM-RI-7650] N72-27420
Concentrations of small ions in air in open country, polluted site, fog, and enclosed room with artifical air conditioning
[NASA-TT-F-14408] N72-27642
Italian atmospheric pollution determined from total beta activity of dust samples collected from 28 ground stations
N72-27653
Optimal control strategies for air quality standards and regulatory policy
[PB-207976] N72-27670
Numerical determination of optimal control strategies for air quality standards and regulatory policy with minimum economic impact of implementation
[PB-207975] N72-27671
Analysis of carbon monoxide, unburned hydrocarbons, and nitrogen oxides in turbojet afterburner combustion products using infrared spectroscopy - Part 1
[AD-739176] N72-27968

AIR TO AIR MISSILES
Mission requirements for air to air missile and digital computer program to synthesize requirements into preliminary design
N72-27682

AIR TO SURFACE MISSILES
Inertial guidance techniques for midcourse guidance and terminal guidance systems with application to control and guidance of tactical standoff missiles
N72-27691

AIR TRAFFIC CONTROL
Change in aircraft congestion due to introduction of STOL aircraft into airport operation
N72-27007
Analysis of terminal area flight procedures and air routes for supersonic transport aircraft on transatlantic flights from Kennedy International Airport, New York
[NASA-TN-D-6801] N72-27010
Performance tests of instrument landing system localizer to include system and monitor stability and monitor operation under degraded system performance
[FAA-RD-72-50] N72-27694
Systems analysis of analog and digital voice coding techniques for use with satellite based air traffic control system
[NASA-CR-122432] N72-27701
Characteristics and operation of air trafic control radar system installed at USSR airports
[JPRS-56463] N72-27705
Methods for performing evaluation and processing data following flight tests of air traffic control beacon
[AD-738680] N72-27709
Procedures for determining capacity of air traffic control systems and application to long range planning, management decisions, and system performance evaluation
[AD-738892] N72-27710
Air traffic control procedures for aircraft carrier operations based on trajectory optimization and computer-aided reassignment
[AD-739713] N72-27713

AIR WATER INTERACTIONS
Analog computer methods used to determine convective heat and mass transfer from water surfaces
[PB-207638] N72-27660

AIRBORNE/SPACEBORNE COMPUTERS
Design of stored program computer for OAO 3
[NASA-TM-X-65937] N72-27211

AIRCRAFT ACCIDENT INVESTIGATION
Analysis of survival following crashes of military aircraft and identification of areas for improvement in structural design
[AD-739370] N72-27044

AIRCRAFT ACCIDENTS
Aircraft accident investigations of crashes of agricultural aircraft and effectiveness of protective equipment in preventing injuries and fatalities
[FAA-AM-72-15] N72-27011
Investigation of midair collision of Boeing 707 commercial aircraft and Cessna 150 near Edison, New Jersey on 9 January, 1971
[NTSB-AAR-72-16] N72-27025

AIRCRAFT APPROACH SPACING
Change in aircraft congestion due to introduction of STOL aircraft into airport operation
N72-27007

AIRCRAFT CARRIERS
Accelerated life tests to determine effects of arrested landing stresses on C-2 aircraft structure
[AD-739331] N72-27036
Air traffic control procedures for aircraft carrier operations based on trajectory optimization and computer-aided reassignment
[AD-739713] N72-27713

AIRCRAFT COMPARTMENTS
Standard formula for allowable cabin leakage in military aircraft
[AD-739687] N72-27048

AIRCRAFT CONTROL
Statistical analysis of XB-70 aircraft responses and control inputs
[NASA-TN-D-6872] N72-27013
Importance of advanced information given to pilots considered as element in automatic control system
[REPT-64] N72-27034

Aircraft position and motion controlled by photogrammetric three reference point method noting coordinate transformations
[SAAB-TN-68] N72-27472
Attitude control and guidance mechanism for spacecraft and aircraft
[NASA-CR-127268] N72-27679

AIRCRAFT DESIGN
Interference problems of airframe engine integration in aircraft design optimization
[AGARD-LS-53] N72-27016
Integration of forebody and forebody/wing flow fields into airplane design criteria
N72-27018
Wind tunnel models for determining inlet interference and performance of inlet/airframe combination in supersonic aircraft design
N72-27019
Wind tunnel test results of exhaust nozzle/airframe interference drag for optimization of subsonic aircraft design
N72-27020
Wind tunnel test requirements for simulating nozzle parameters and nozzle airframe interference characteristics
N72-27021
Determination of thrust and drag characteristics for integrated aircraft engine design optimization
N72-27023
Acoustic measurement tests to determine reduction of aerodynamic noise by engine-over-wing concept for conventional and STOL aircraft
[NASA-TM-X-68104] N72-27030

AIRCRAFT ENGINES
Engine airplane interference corrections in calculating model aircraft performance from wind tunnel test data
N72-27017
Aircraft engine maintenance, military training, and antiaircraft defense
[AD-739974] N72-27991

AIRCRAFT EQUIPMENT
Design and development of spin-recovery parachute systems for military aircraft and compilation of design criteria
[NASA-TN-D-6866] N72-27033

AIRCRAFT FUELS
Discussion of aircraft fuels and lubricants to include production, analysis, testing and fire safety
[AGARD-AR-44] N72-27811

AIRCRAFT GUIDANCE
Aircraft position and motion controlled by photogrammetric three reference point method noting coordinate transformations
[SAAB-TN-68] N72-27472
Attitude control and guidance mechanism for spacecraft and aircraft
[NASA-CR-127268] N72-27679

AIRCRAFT HAZARDS
Statistical analysis of military aircraft damaged by midair collisions with birds during 1972
[AD-739464] N72-27041

AIRCRAFT LANDING
Six degree of freedom simulator tests to determine effects of motion cues on short takeoff and landing aircraft approach
[NASA-CR-114458] N72-27032
Accelerated life tests to determine effects of arrested landing stresses on C-2 aircraft structure
[AD-739331] N72-27036
Analysis of pilot performance in establishing specific glide path by reference to oblong diamond marks on runway
[FAA-NA-72-57] N72-27702

AIRCRAFT NOISE
Measurement of aircraft noise generated by YOV-10A short takeoff aircraft and comparison with wind tunnel data
[NASA-TM-X-62166] N72-27031
Noise environment of C-7A during ground and airborne operation
[AD-738627] N72-27086
Environmental impact surveys of quiet engine program
[NASA-TM-X-68545] N72-27814

AIRCRAFT PERFORMANCE
Compilation of technical reports on theoretical aerodynamics, aircraft performance, sonic booms, aircraft stability, and turbulent boundary layers - Vol. 2
[SBN-11-470152-0] N72-26994
Procedures for evaluating effect of transfer function zeros on transient response of aircraft and determining desirable regions of pole-zero locations
[NASA-TM-X-2585] N72-27024
Analysis of military requirements and specifications for aircraft performance using F-5 aircraft
[AD-738625] N72-27039
Determination of upwash angles for short takeoff aircraft lifting system using two dimensional potential flow analysis
[NASA-TM-X-2593] N72-27817

AIRCRAFT PILOTS
Cholinesterase methods for assaying pesticide poisoning in blood of aerial applicator personnel
[FAA-AM-72-12] N72-27080

AIRCRAFT STABILITY
Procedures for evaluating effect of transfer function zeros on transient response of aircraft and determining desirable regions of pole-zero locations
[NASA-TM-X-2585] N72-27024
Antiaircraft missile, military training, and aircraft stability
[AD-739973] N72-27990

AIRCRAFT STRUCTURES
Development, stress analysis, and manufacturing of horizontal stabilizer for A-4 aircraft using graphite-epoxy laminates in primary structure
[AD-738900] N72-27040

AIRFOILS
Method for designing wind tunnel model airfoil with integrally formed pressure measurement orifices
[NASA-CASE-LAR-10812-1] N72-27272
Separated flow point determination on blown flap airfoil of STOL wing propulsion system
N72-27286
Computer program for airfoil pressure distribution for subcritical viscous attached flow
[NAL-TR-248] N72-27317
Influence of jet mixing with ambient air on flow around airfoil with jet flap
[AD-739205] N72-27329
Computer program for coordinates, incompressible inviscid section characteristics, and two dimensional drag-rise for NACA airfoils
[AD-738623] N72-27332

AIRFRAMES
Interference problems of airframe engine integration in aircraft design optimization
[AGARD-LS-53] N72-27016

AIRGLOW
Functional characteristics of OGO-4 main body airglow photometer utilizing cathode photomultiplier to sense light at selected wavelengths
[NASA-TM-X-65926] N72-27423

AIRLINE OPERATIONS
Economic analysis of transport aircraft operating in transonic region with consideration of materials, aerodynamic configuration, and cruise speed
[NASA-TM-X-62159] N72-27015
Factors affecting optimum flight routes for supersonic transport aircraft operation
[NLL-M-22436-[5828.4F]] N72-27672

AIRPORTS
Transportation planning for airports and other intercity terminals
[PB-207529] N72-27280
Environmental impact survey of airport on Park Falls, Wisconsin
[PB-204025-F] N72-27284

ALABAMA
Environmental impact statement for Marshall Space Flight Center Huntsville, Ala, and MTF in Hancock County Mississippi
[NASA-TM-X-68542] N72-27264

ALCOHOLS
Gas chromatographic analysis of alcohols and mercaptans
[NASA-TT-F-14348] N72-27153

ALGORITHMS
Development of algorithm based on matrix methods for solution of wind tunnel force-balance equations and iterative solution using automatic computer reduction
[NASA-TN-D-6860] N72-27002
Computerized graph techniques based on algorithms with several applications including molecular structures and networks
[REPT-127] N72-27221
Hydrological computer codes and algorithms for water management and snow surveys
[NLL-M-22339-[5828.4F]] N72-27342
Analysis principles of strapdown inertial platforms with emphasis on rebalance loop electronics and attitude algorithms
N72-27674
Application of attitude transformation algorithms for strapdown inertial platforms and realization by digital differential analyzers
N72-27677

ALKALI METALS
Thermal conductivity of neon, krypton, xenon, and vapors of alkali metals with dissociation calculation and thermophysical properties of gases
[AD-738737] N72-27161
Low temperature plasma transfer, including vapor diffusion of alkali metals
[AD-738739] N72-27781

ALKYLATION
Internal plasticization of aromatic polyesters by side chain alkylation noting 5 alkyl resorcinol isophtalate polymer glass transition temperature measurements
[RAE-TR-71223] N72-27158

ALL-WEATHER AIR NAVIGATION
Microwave interferometers used as radio eye for aircraft navigation and collision avoidance system including comparison of cost with present systems
[REPT-62] N72-27708
Group cohesion, interceptors, all-weather operations, and flight safety
[AD-739229] N72-27988

ALLOCATIONS
Congressional hearings to determine fiscal year 1973 funding of HUD, NASA, NSF, VA, and several independent committees
N72-27977
Statistical analysis of Federal obligations awarded to universities and colleges for academic science activities for fiscal year 1970
[NSF-72-301] N72-27978

ALPHA PARTICLES
Bibliography on helium and alpha particles
[BM-IC-8523] N72-27155

ALTITUDE SIMULATION
Test firing of Thiokol TE-T-607-1 engine at simulated altitude conditions
[AD-739191] N72-27828

ALTITUDE TESTS
Life support system for rescue crew in altitude chamber tests
N72-27133

ALUMINUM
Vacuum extraction of aluminum during interaction with water
[NLL-M-21374-[5828.4F]] N72-27145
Solubility and diffusion in titanium-aluminum-hydrogen systems, and degasification due to titanium
[NLL-294-[8660.5]] N72-27570

ALUMINUM ALLOYS
Uniform elongation and work hardening of sheet and spherical aluminum and copper alloys, brass, and steel
[NLL-TRANS-746-1121-[9022.401]]
N72-27557
Solubility and diffusion in titanium-aluminum-hydrogen systems, and degasification due to titanium
[NLL-294-[8660.5]] N72-27570
Mechanism of fatigue enhancement in selected high strength aluminum alloys related to unique microstructures
[AD-738450] N72-27584
Hydrogen-dislocation interactions in alpha titanium aluminum alloys studied via internal friction measurements at high temperatures
[AD-739696] N72-27593
Corrosion inhibiting properties of epoxy primers used in aluminum alloys
[AD-738446] N72-27606

ALUMINUM CARBIDES
Effect of aluminum carbide formation on mechanical properties of model carbon-aluminum composite
[ARL/MET-87] N72-27601

ALUMINUM OXIDES
Thermal stability of aluminum oxide whiskers in silicon-aluminum alloy matrix
[AD-736973] N72-27608
Photoemission energy distributions of aluminum oxide and evaporated aluminum films
[AD-739198] N72-27801

AMMONIUM PERCHLORATES
High heating rate, thermoanalytical technique for studying condensed phase reactions of binder fuels and ammonium perchlorate based, propellant-like materials
N72-27813

AMMONIUM PHOSPHATES
Coherent visible light, continuously tunable at 4200 to 7300 A, from optical pumping ammonium dihydrogen phosphate
[AD-739384] N72-27747

AMPLIFIER DESIGN
Isolated dc amplifier for bioelectric measurements
[NASA-CASE-ARC-10596-1] N72-27233

AMPLIFIERS
Josephson junction amplifier performance
[AD-739383] N72-27243

AMPLITUDE MODULATION
Statistics and environmental causes of amplitude modulation near ocean surface
[AD-739357] N72-27388

ANALOG DATA
Intasat satellite codification unit receiving data in digital and analog form
[NASA-TT-F-13899] N72-27171

ANALOG SIMULATION
Analog computer methods used to determine convective heat and mass transfer from water surfaces
[PB-207638] N72-27660

ANALOG TO DIGITAL CONVERTERS
Converter modules for underwater to surface guided missiles
[AD-739248] N72-27222

ANALYZERS
Automated, six channel, discrete sample electrolyte analyzer, using peristaltic pump
[AD-737568] N72-27091

ANEMOMETERS
Transonic wind tunnel calibration of dual system gust measuring probe
[ARL/A-NOTE-334] N72-27426

ANIONS
Anion effect in hydrogen adsorption on platinum electrode
[NASA-TT-F-14361] N72-27152

ANISOTROPY
Diffusion model for energy dependence of electron anisotropy in cosmic rays
[RM-548] N72-27838

ANNEALING
Optical and electron microscopic examination of metallic Nichrome matrix grain growth behavior during annealing
[NLL-TRANS-746-1173-[9022.401]] N72-27563
Fracture strength of high strength steel HFX 103 after quenching and annealing for weldability assessment
[T-MITT-4/71] N72-27579

ANNUAL VARIATIONS
Italian atmospheric pollution determined from total beta activity of dust samples collected from 28 ground stations N72-27653
Semiannual atmospheric density variations in exosphere June 1968 through December 1970
[RAE-TR-71150] N72-27897

ANNULAR NOZZLES
Cold air performance of annular nozzle cascade on transonic axial flow turbine
[NAL-TR-272] N72-27823

ANNULI
Turbulent boundary layers along curved walls of axisymmetric diffusing annulus
[NAL-TR-278T] N72-27316

ANTENNA RADIATION PATTERNS
Pattern analyses for paraboloid and elliptical antennas on synchronous satellites
[NASA-CR-112102] N72-27173
Computer programs for analyzing electromagnetic radiation fields of bent thin wire antennas and scatterers
[AD-739203] N72-27190
System for locating lightning strokes by coordination of directional antenna signals
[NASA-CASE-KSC-10729-1] N72-27234

ANTIAIRCRAFT MISSILES
Antiaircraft missile, military training, and aircraft stability
[AD-739973] N72-27990

ANTIFERROMAGNETISM
Influence of relaxation processes on Mossbauer measurements of superparamagnetic alpha-FeOOH and alpha-Fe2O3 crystallites N72-27793
Magnetic phase transitions in presence of external magnetic fields and effect of low temperature on transitions of antiferromagnetic materials
[AD-739259] N72-27800

ANTIFRICTION BEARINGS
Computer programs to predict friction torque and service life of series-hybrid bearing assembly
[NASA-TM-X-68093] N72-27528
Test and evaluation of antifriction bearings for use in turbine-alternator-compressor units of Brayton cycle electric power supply
[NASA-TM-X-68095] N72-27529

APOLLO FLIGHTS
Gemini and Apollo observations of geologic structure of Baja California
[NASA-CR-127259] N72-27356
Origin of moon based on Apollo lunar samples
[NASA-TM-X-65924] N72-27886

APOLLO PROJECT
Environmental impact statement of Apollo project based on ten Apollo spacecraft and Saturn 5 launch vehicle operations at Cape Kennedy Launch Complex, Florida
[NASA-TM-X-68544] N72-27903

APOLLO SPACECRAFT
Facilities and environmental measurements to be monitored in support of Apollo/Saturn vehicle AS-511
[NASA-TM-X-68517] N72-27261
Convection and mixing of stratified fluid in rotating container for Apollo spacecraft
[NASA-TR-R-386] N72-27313
Development of procedures for preparation of space vehicle and launch vehicle for subsequent launch following cancellation of prior attempt
[NASA-TM-X-68516] N72-27917

APOLLO 16 FLIGHT
Magnetic field tests of Apollo 16 LRV
[NASA-TM-X-65927] N72-27274
Geochemical mapping of lunar surface by Apollo 16 spacecraft for Al, Mg, and Si
[NASA-TM-X-65918] N72-27880

APPLICATIONS TECHNOLOGY SATELLITES
Results of 15.3 GHz observations with ATS-5 satellite
[NASA-CR-122438] N72-27174
VHF correlation radio interferometer consisting of two superheterodyne receivers for investigating ionospheric disturbances by receiving signals from ATS satellites
[NASA-CR-127270] N72-27345
ATS pictures for meteorological applications and satellite-borne instruments
[NASA-CR-122437] N72-27646
Interactive man-computer system for measuring cloud motion from ATS pictures N72-27647
Data reductation and spacecraft position determination used in two ATS experiments
[NASA-TM-X-65920] N72-27885

APPROPRIATIONS
Congressional appropriation in response to fiscal year 1973 budget requests submitted by HUD, NASA, NSF, and VA
[S-REPT-92-820] N72-27973
Congressional appropriations hearings for fiscal year 1973 funds required by HUD, NASA, NSF, and VA
[H-REPT-92-1071] N72-27974

APPROXIMATION
Numerical approximation of non-Cauchy-Kowaleska systems in hydrodynamics N72-27295
Three approximation methods for full Navier-Stokes equations for two and three dimensional unsteady flow N72-27296
Approximations for difference problem with oblique derivitive in half plane
[NASA-TT-F-14346] N72-27617
Approximation of abstract Cauchy problem, and its convergence
[NAL-TR-269T] N72-27619

AQUEOUS SOLUTIONS
Dissolution behavior of metallic oxides and iron base compounds in aqueous solutions
[AD-739395] N72-27590

ARGON
Electron densities in ionization relaxation zone behind shock waves in argon
[CP-32] N72-27774

ARGON PLASMA
Ion acoustic solitary waves and shocks in two-component argon plasma
[NASA-CR-127387] N72-27770
Relaxation profiles of ionizing shock wave in argon
[CP-36] N72-27772
Electron temperature and density in shock-produced argon plasma
[CP-33] N72-27773

ARIZONA
Discrimination of sodium D2 line in surficial desert and semidesert deposits of California and Arizona
[NASA-CR-127529] N72-27353

ARM [ANATOMY]
Analysis of arm performance subjected to external load during crank turning task
[AD-739478] N72-27096

ARMED FORCES
Missile military personnel management appropriations
[AD-739504] N72-27989
Antiaircraft missile, military training, and aircraft stability
[AD-739973] N72-27990
Aircraft engine maintenance, military training, and antiaircraft defense
[AD-739974] N72-27991

ARMED FORCES [FOREIGN]
Scientific research projects on lasers, surveillance, armaments, materials and weapon analysis
[DREV-666/72] N72-27982

AROMATIC COMPOUNDS
Internal plasticization of aromatic polyesters by side chain alkylation noting 5 alkyl resorcinol isophtalate polymer glass transition temperature measurements
[RAE-TR-71223] N72-27158

ARRAYS
Noise reduction and signal to noise ratio for seismic arrays for twenty-four hour events
[AD-739181] N72-27394

ARRESTING GEAR
Accelerated life tests to determine effects of arrested landing stresses on C-2 aircraft structure
[AD-739331] N72-27036

ARTIFICIAL CLOUDS
Max-Planck-Institute Studies of Extraterrestrial Physics, noting barium cloud experiment
[MPI-PAE-EXTRATERR-59] N72-27896

ARTIFICIAL GRAVITY
Gravity simulation by rotation and effects on human performance
[NASA-CR-111866] N72-27104

ARTIFICIAL INTELLIGENCE
Pattern recognition computer networks for layered input transformation processing
[NASA-CR-127266] N72-27208

ARTIFICIAL RADIATION BELTS
Maximum flux vs azimuth as function of time following detonation of source of radiation belt electrons
[AD-739495] N72-27405

ARTIFICIAL SATELLITES
Effects of orbital perturbations on responses of gyroscope system for testing relativity theory in polar orbiting satellite
[AD-739500] N72-27712

ARTILLERY
Meteorological radar surveillance of atmospheric conditions during artillery tests conducted in Panama
[AD-739485] N72-27666

ASCENT TRAJECTORIES
Optimization techniques for estimating height-velocity diagram and critical decision point for rotorcraft based on impulsive response functions
[NAL-TR-245] N72-27026

ASIA
Relationship between cloud brightness, rainfall, and runoff in Surinam N72-27649

ASTRONAUTS
Portable life support system for astronaut working outside of lunar module N72-27109

ASTRONAVIGATION
Characteristics of air navigation systems and methods for improving accuracy of navigation instruments and systems
[JPRS-56487] N72-27704

ASTRONOMICAL CATALOGS
Proper motions of 1357 faint stars - catalog
[NASA-CR-127264] N72-27849

ASTRONOMICAL PHOTOMETRY
Infrared photometry of galactic and quasar nuclei
[AD-739196] N72-27901

ASTRONOMICAL TELESCOPES
Quality control of lightweight cast honeycomb structure mirrors for infrared astronomical telescope detectors N72-27452

ASTRONOMY
Soviet bloc research in astronomy, meteorology, oceanography, geology, and space science - 30 June 1972
[JPRS-56398] N72-27884
Soviet bloc research in astronomy, meteorology, oceanography, geology, and space science - 7 July 1972
[JPRS-56444] N72-27890

ASYMMETRY
Rate gyro using asymmetrical rotor for rocket attitude control
[NAL-TR-259] N72-27429

ATLANTIC OCEAN
Sea surface temperature distribution for Atlantic Ocean and Mediterranean Sea
[NLL-M-22342-[5828.4F]] N72-27338
Synoptic analysis of weather conditions over Atlantic Ocean and Europe for period 14 to 17 February 1962 as basis for determining atmospheric energetics
[REPT-127] N72-27636

ATMOSPHERIC CIRCULATION
Relation between stratospheric circulation and pressure distributions at summer-autumn transition and following winter severity for Kyushv district
[NLL-M-22196-[5828.4F]] N72-27637
Measurements of upper-atmosphere rotational speed from changes in satellite orbits
[RAE-TR-71171] N72-27900

ATMOSPHERIC COMPOSITION
Neutral composition measurements of mesosphere and lower thermosphere
[AD-739169] N72-27664
Gas-surface interactions and ambient neutral particle densities determined from OGO-6 quadrupole mass spectrometer data
[NASA-TM-X-65923] N72-27887

ATMOSPHERIC DENSITY
Triaxial piezoelectric accelerometer with sensitivity to extend upper limit of falling sphere type of upper atmospheric density measuring system
[AD-739202] N72-27473
Semiannual atmospheric density variations in exosphere June 1968 through December 1970
[RAE-TR-71150] N72-27897

ATMOSPHERIC DIFFUSION
Pitch-angle diffusion and stably trapped limits for protons in Earth and Jupiter magnetospheres N72-27867

ATMOSPHERIC ELECTRICITY
Static electrification, bonding, grounding, and lightning protection techniques applied to aircraft, spacecraft, and missiles
[AD-739356] N72-27037
Atmospheric electricity and earth meteorology
[NLL-M-22318-[5828.4F]] N72-27336

ATMOSPHERIC ENTRY
Analysis of effect of high injection rates on laminar boundary layer and relation to atmospheric entry conditions
[JPRS-56437] N72-27322

ATMOSPHERIC MODELS
Atmospheric models for mesoscale and small scale effects which influence global climate and weather
[AD-739541] N72-27669
Atmospheric models for white dwarfs N72-27842
Best estimate and upper limit models for Jupiter electron and proton trapped radiation belt N72-27873

Proposed and alternative models of Jupiter radiation belts
N72-27874
Models for charged particle populations of Jupiter trapped radiation belts
N72-27875

ATMOSPHERIC PHYSICS
Development and characteristics of apparatus for measuring intensity of electric field in atmosphere
[NASA-CASE-KSC-10730-1] N72-27431
Activities of National Center for Atmospheric Research during 1971 with emphasis on cooperation with other research organizations and activities
[AR-10] N72-27979

ATMOSPHERIC PRESSURE
Relation between stratospheric circulation and pressure distributions at summer-autumn transition and following winter severity for Kyushv district
[NLL-M-22196-[5828.4F]] N72-27637

ATMOSPHERIC RADIATION
Ground based Portugal observations of luminous magnetospheric phenomena caused by barium ion release
[AERONOMICA-ACTA-A-102] N72-27372
Use of actinometric instruments for atmospheric radiation measurements
[TT-70-50159] N72-27663
Solar cycle effects on excess radiation intensity at low altitudes
N72-27839

ATMOSPHERIC TEMPERATURE
Series connected thermocouples for temperature measuring device in atmospheric turbulence studies
[NLA-TR-260] N72-27427
Relation between amount and depth of radiation inversions at night and diurnal range of air temperature at 2-m height in different USSR regions
[NLL-M-22336-[5828.4F]] N72-27630
Weather predictions for Concorde test flights and problems of forecasting stratospheric temperature and clear air turbulence
[NLL-M-22439-[5828.4F]] N72-27638

ATMOSPHERIC TIDES
Atmospheric tidal measurements from high altitude balloon
[AD-739486] N72-27403

ATMOSPHERIC TURBULENCE
Numerical analysis of response of spherical balloon to atmospheric turbulence and three-dimensional time-dependent flows
[NASA-TN-D-6829] N72-27001
Effects of upper atmosphere turbulence on operation of supersonic transport aircraft and methods for advance detection of atmospheric turbulence
[NLL-M-22437-[5828.4F]] N72-27009
Series connected thermocouples for temperature measuring device in atmospheric turbulence studies
[NLA-TR-260] N72-27427

ATOMIC CLOCKS
Absolute hydrogen hyperfine transition frequency of atomic hydrogen maser clock
[NASA-TM-X-65936] N72-27549

ATOMIC COLLISIONS
Inversion, atom-atom collisions and velocity, and undulations
[NASA-CR-127258] N72-27755
Simple classical mechanical model for reactive scattering of atom and quasi-diatomic molecule using conservation relations
[NASA-CR-127260] N72-27756

ATOMIC ENERGY LEVELS
Expressions for contributions by first and second order Feynman diagrams in terms of radial integrals for light atoms
[NASA-TT-F-14403] N72-27752
Numerical calculations of contributions by first and second order Feynman diagrams for light atoms
[NASA-TT-F-14402] N72-27753

ATOMIC PHYSICS
Research in Hungary, Poland, Romania, and Yugoslavia in fields of physics, space science, and medicine
[JPRS-56289] N72-27733

ATS 3
Time lapse cloud brightness data from ATS 3 and correlation of cirrus shield variations in time to rainfall rate in midlatitude storm complexes
N72-27648

ATTITUDE CONTROL
Performance tests to determine problems associated with hovering, vertical takeoff, and landing of VTOL aircraft with emphasis on attitude control
[NAL-TR-276] N72-27027

ATTITUDE GYROS
Rate gyro using asymmetrical rotor for rocket attitude control
[NAL-TR-259] N72-27429

AUDIO FREQUENCIES
Audio frequency analysis circuit for determining, displaying, and recording frequency of sweeping audio frequency signal
[NASA-CASE-NPO-11147] N72-27408

AUDITORY DEFECTS
Human eardrum rupture and hearing loss injuries from nuclear explosions
[AD-737643] N72-27092

AURORAL ARCS
Three midlatitude, red auroral arcs observed from OV-1 satellite
[AD-737544] N72-27902

AURORAL ELECTROJETS
Microphone detection of infrasound during magnetic storms caused by supersonic motion of auroral electrojets
[KGO-727] N72-27384

AURORAL ZONES
Analysis of very low frequency auroral zone in Alaska to determine effect on accuracy of Omega navigation system in polar regions
[AD-739689] N72-27714

AURORAS
Time resolution measurements of energetic electrons in auroral breakup, and electron multiplier
[NASA-CR-127522] N72-27346
Cross sections for emission of Lyman alpha radiation in collisions of 1-25 keV protons and hydrogen atoms with constituents of planetary atmospheres
[AD-739184] N72-27395

AUSTENITE
Surface properties and service life of metastable austenite
[NLL-TRANS-746-1100-[9022.401]] N72-27556

AUSTENITIC STAINLESS STEELS
Activity and solubility of carbon in austenitic chromium-nickel steels with approximately 18 percent Cr at temperatures between 950 and 1200 C
[NLL-CE-TRANS-5881-[9022.09]] N72-27561
Production of austenitic-boride steels and alloys for welded structures with emphasis on effects of boron on weldability, refractoriness, and corrosion
[JPRS-56406] N72-27578

AUTOMATA THEORY
Automata with undirected labeled graphs as Turing machines
[TR-72-182] N72-27216

AUTOMATIC CONTROL
Feasibility determination for continuous automated analysis and control of production phosphate coating baths
[AD-739510] N72-27611
Techniques for control and guidance of tactical missiles with emphasis on cost, reliability, and performance
[AGARD-LS-52] N72-27681
Numerical analysis of adjoint equations yielding error sensitivities in linear systems applied to guidance and control of tactical missiles
N72-27684

AUXILIARY POWER SOURCES
Design, analysis, and performance of space shuttle auxiliary power systems
[NASA-CR-1995] N72-27054
Analysis of selected supporting systems for use with auxiliary power unit for space shuttle - Vol. 4
[NASA-CR-1996] N72-27064

AXIAL FLOW TURBINES
Cold air performance of single stage axial flow turbine
[NAL-TR-273] N72-27822
Cold air performance of annular nozzle cascade on transonic axial flow turbine
[NAL-TR-272] N72-27823
Photoelastic measurement of stresses on axial flow compressor disc with numerous pin hole perforations
[NAL-TR-274] N72-27948

AXIAL LOADS
Fracture and stress-strain behavior of ATJ-S graphite under uniaxial, biaxial, and triaxial stresses
[AD-739204] N72-27604

AXISYMMETRIC BODIES
Turbulent boundary layers along curved walls of axisymmetric diffusing annulus
[NAL-TR-278T] N72-27316
Motion of nutation damper on spin-stabilized axisymmetric spacecraft
[NAL-TR-251] N72-27892

B

BALL BEARINGS
Computer programs to predict friction torque and service life of series-hybrid bearing assembly
[NASA-TM-X-68093] N72-27528

BALLOON FLIGHT
Radar altimeter design for high altitude balloon flights
N72-27650

BALLOON SOUNDING
Atmospheric tidal measurements from high altitude balloon
[AD-739486] N72-27403
Environmental impact statement for physics and astronomy sounding rocket, balloon, and airborne research programs
[NASA-TM-X-68556] N72-27909

BALLOONS
Numerical analysis of response of spherical balloon to atmospheric turbulence and three-dimensional time-dependent flows
[NASA-TN-D-6829] N72-27001

BANDPASS FILTERS
Research and development of bandpass filters for 2 to 20 micron range, noting transmission efficiency
N72-27447

BARIUM
Ground based Portugal observations of luminous magnetospheric phenomena caused by barium ion release
[AERONOMICA-ACTA-A-102] N72-27372
Max-Planck-Institute Studies of Extraterrestrial Physics, noting barium cloud experiment
[MPI-PAE-EXTRATERR-59] N72-27896

BARYON RESONANCES
Effect of radial wave functions for baryons in symmetric quark model
[TR-72-122] N72-27765
Radial baryon excitation modes in symmetric quark model
[TR-72-088] N72-27766

BAYES THEOREM
Smooth empirical Bayes estimator for random scale components of observation error variances for discrete time linear system
[NASA-CR-127527] N72-27620

BAYS [TOPOGRAPHIC FEATURES]
Subbottom acoustic reflection profiles for Bay of Campeche in Gulf of Mexico
[PB-207594] N72-27391

BEAM CURRENTS
Measurement of beam currents in millions of amperes using megampere accelerator
[AD-739294] N72-27281

BEAMS [SUPPORTS]
Vibration analysis of three parallel beams with different rigidities based on Rayleigh-Ritz method with three approximated deflection functions
[NAL-TR-271] N72-27949

BEDS [PROCESS ENGINEERING]
Local obstruction influence on heat transfer between packed bed sphere and coolant gas
[VKI-TN-80] N72-27725

BERYLLIUM
Production of ultrafine beryllium particles by electrolysis
[NASA-CR-127427] N72-27577

BETA PARTICLES
Italian atmospheric pollution determined from total beta activity of dust samples collected from 28 ground stations
N72-27653

BETHE-SALPETER EQUATION
Solution of 0[3]-invariant Bethe-Salpeter equation and variational method for solving radial equation
[TR-72-111] N72-27622
Bound state Bethe-Salpeter equation
[TR-72-101] N72-27623
First and second moments of optical wave propagating in random medium and solution equivalence of Dyson and Bethe-Salpeter equation and Huygens-Fresnal principle
[AD-739185] N72-27746

BIBLIOGRAPHIES
Annotated bibliography and indexes on Aerospace Medicine and Biology - May 1972
[NASA-SP-7011[102]] N72-27076
Bibliography of simulation models for vegetation
[NASA-CR-127426] N72-27082
Bibliography on helium and alpha particles
[BM-IC-8523] N72-27155
Titles and authors of reports from Second Scientific Technical Conference on Radio Communication
[NASA-TT-F-14406] N72-27169
Bibliography of technical reports on jet impingement, flow, and diffusion
[CE-BIBL-224] N72-27321
Annotated bibliography of remote sensing of air and water pollution for 1965 through 1970
[AD-737588] N72-27406
Bibliography on magnetometers and techniques for measuring earth's magnetic field
[M70-43/8] N72-27415
Bibliography on linear electro-optic modulator materials
[AD-739360] N72-27742

BILLETS
Various powder metallurgy and quench lasting techniques used in billet processing to generate extremely fine dendrite arm spacings and homogenous structures
[AD-739340] N72-27580

BIMETALS
Selection of intermediate layer material for application to production of corrosion-resistant bimetal
[NLL-TRANS-746-1147-[9022.401]] N72-27559

BINARY ALLOYS
Conversions in Pt-Fe system, and proof of super lattices Fe3Pt and FePt3
[NASA-TT-F-14320] N72-27576

BINARY CODES
Binary coding of continuous time communications
[NASA-TT-F-13896] N72-27207

BINARY DIGITS
Baseline communications channel model for studying low bit rate telemetry transmissions from Explorer satellites
[NASA-CR-122435] N72-27168
Structural data coding method using numbered binary sequences
[NASA-TT-F-13895] N72-27172

BINAURAL HEARING
Binaurally time delayed signal generator for improved speech intelligibility
[AD-738628] N72-27192

BIOASSAY
Cholinesterase methods for assaying pesticide poisoning in blood of aerial applicator personnel
[FAA-AM-72-12] N72-27080

BIOCONTROL SYSTEMS
Multichannel bioelectric control system for simulating neuromuscular movements and treating motor function disturbances
[NRC-TT-1552] N72-27134

BIODYNAMICS
Analysis of arm performance subjected to external load during crank turning task
[AD-739478] N72-27096
Hearing, bioacoustics, and biomechanics for biodynamic models - conference
[AD-739501] N72-27140

BIOELECTRICITY
Bioelectric system for control of muscular activity
[NRC-TT-1551] N72-27083
Multichannel bioelectric control system for simulating neuromuscular movements and treating motor function disturbances
[NRC-TT-1552] N72-27134

BIOENGINEERING
Isolated dc amplifier for bioelectric measurements
[NASA-CASE-ARC-10596-1] N72-27233

BIOLOGICAL EFFECTS
Annotated bibliography and indexes on Aerospace Medicine and Biology - May 1972
[NASA-SP-7011[102]] N72-27076

BIOMETRICS
Compressible electrolyte saturated sponge electrode for biomedical applications
[NASA-CASE-MSC-13648] N72-27103

BIRDS
Statistical analysis of military aircraft damaged by midair collisions with birds during 1972
[AD-739464] N72-27041

BIT SYNCHRONIZATION
Electrical/mechanical properties, operation, theory of operation, parts list, and electrical diagrams for model 5208A bit synchronizer unit
[NASA-CR-115645] N72-27218

BLACK AND WHITE PHOTOGRAPHY
Pseudocolor separation process for gray interpretation in black and white conversion to chromatic image
[P-4804] N72-27738

BLAST LOADS
Development of apparatus for detonating explosive devices in order to determine forces generated and detonation propagation rate
[NASA-CASE-LAR-10800-1] N72-27959

BLOCKING
Local obstruction influence on heat transfer between packed bed sphere and coolant gas
[VKI-TN-80] N72-27725

BLUNT BODIES
Pressure distribution and shear effect on blunt bodies produced by bow shock wave under supersonic speed conditions
[NAL-TR-266] N72-26998
Extension of time dependent technique for inviscid blunt body flow to viscous flow
N72-27303
Electron energy along stagnation point streamline ahead of blunt body in nonequilibrium, partially ionized gas at supersonic speed
[CP-35] N72-27319
Empirical formulas for aerodynamic coefficients of blunted cones in rarefied gas
[AD-739214] N72-27331

BOATTAILS
Jet effects on boattail drag of nozzles with truncated conical bodies at supersonic speed and varying ratios of boattail length to maximum diameter
[NASA-TN-D-6789] N72-26997

BODIES OF REVOLUTION
Force parameters in rotary extrusion of thin walled shells of revolution
[NLL-M-21379-[5828.4F]] N72-27489

BODY-WING CONFIGURATIONS
Integration of forebody and forebody/wing flow fields into airplane design criteria
N72-27018

BOEING 707 AIRCRAFT
Investigation of midair collision of Boeing 707 commercial aircraft and Cessna 150 near Edison, New Jersey on 9 January, 1971
[NTSB-AAR-72-16] N72-27025

BOLOMETERS
Performance and specifications of thermistor bolometers for sensing horizon for attitude control
N72-27437
High resolution three part bolometer for far infrared detection
N72-27438

BONDING
Static electrification, bonding, grounding, and lightning protection techniques applied to aircraft, spacecraft, and missiles
[AD-739356] N72-27037

BOOSTER ROCKET ENGINES
Technical data supplement for solid rocket motor of space shuttle booster
[NASA-CR-127416] N72-27821

BORESIGHTS
Opthalmologic examinations for determining retina damage caused by helium-neon laser boresights
[AD-738629] N72-27087

BORON
Boron atom diffusion in silicon coatings
[PUBL-884] N72-27600

BORON COMPOUNDS
Production of austenitic-boride steels and alloys for welded structures with emphasis on effects of boron on weldability, refractoriness, and corrosion
[JPRS-56406] N72-27578

BOUNDARY LAYER FLOW
Vortex model for describing steady and unsteady free boundary flows
N72-27287
Elastic boundary interaction with viscous sublayer of turbulent boundary layer flow for drag reduction
[NASA-TT-F-14391] N72-27315
Analysis of effect of high injection rates on laminar boundary layer and relation to atmospheric entry conditions
[JPRS-56437] N72-27322

BOUNDARY LAYER SEPARATION
Method for calculating lowest suction rate to prevent laminar boundary layer separation of semibonded stream
[AD-739222] N72-27330

BOUNDARY LAYER TRANSITION
Wind tunnel tests to determine effect of three dimensional sonic jets to promote boundary layer transition on sharp leading edge flat plate at hypersonic speed
[NASA-TN-D-6802] N72-27312

BOUNDARY LAYERS
Development of thermocouple instrument for measuring temperature of wall heated by flowing fluid without disturbing boundary layer
[NASA-CASE-XLE-05230] N72-27410
Relationship between turbulence coefficient and temperature and wind distribution in lower boundary layer
[AD-739221] N72-27658

BOUNDARY VALUE PROBLEMS
Application of impulsive step function technique for solving boundary value problem of elliptic cylindrical cavity in infinite solid
[TAE-148] N72-27951

BOW WAVES
Shock wave oscillation in unsteady axisymmetric supersonic flow as model of earth bow shock
[ESRO-SN-113] N72-27383

BRASSES
Uniform elongation and work hardening of sheet and spherical aluminum and copper alloys, brass, and steel
[NLL-TRANS-746-1121-[9022.401]]
N72-27557

BRAYTON CYCLE
Test and evaluation of antifriction bearings for use in turbine-alternator-compressor units of Brayton cycle electric power supply
[NASA-TM-X-68095] N72-27529

BRAZING
Stress rupture tests of brazed joints at elevated temperatures with emphasis on effects of oxidation
[NLL-LTI-746-1165-[9022.401]]
N72-27941

BREATHING APPARATUS
Conference on portable life support systems for human protection
[NASA-SP-302] N72-27106
Portable breathing apparatus containing chlorate candle oxygen source for mine rescue operations
N72-27112
Human tolerance to external respiratory resistance for design of breathing apparatus
N72-27127
Control system analysis for mathematical modeling of respiratory protective devices
N72-27128
Simulation and design of breathing metabolic simulator
N72-27129
Operational performance of pneumatic seal-type facemask design
N72-27130

BRIDGES (STRUCTURES)
Series of welded structure design
N72-27509
Development of techniques to improve aerodynamic stability of suspension bridges and reduce effects of wind loads
[NLL-M-22432-[5828.4F]] N72-27944

BRIGHTNESS
Time lapse cloud brightness data from ATS 3 and correlation of cirrus shield variations in time to rainfall rate in midlatitude storm complexes
N72-27648

BRITTLE MATERIALS
Fracture mechanics approach to thermal shock resistance of brittle materials
[AD-739494] N72-27609

BRITTLENESS
Analyzing failure of welded structures to determine design criteria for preventing brittle fracture initiation
N72-27495
Effects of cerium additions on ductility, brittle fracture, and strength of low alloy normalized steels
[NLL-T-518-[9022.305]] N72-27565

BUDGETING
Missile military personnel management appropriations
[AD-739504] N72-27989

BURNING RATE
Different combustion diagrams of jets for study on turbulent pulsations in temperature
[AD-739292] N72-27970

BUS CONDUCTORS
Switching circuits and relays for bus conductor reliability
[AD-739213] N72-27237

BYPASSES
Electrical interconnection of unilluminated solar cells in solar battery array
[NASA-CASE-GSC-10344-1] N72-27053

C

C-2 AIRCRAFT
Accelerated life tests to determine effects of arrested landing stresses on C-2 aircraft structure
[AD-739331] N72-27036

CADASTRAL MAPPING
Geology, climatology, land use, and cadastral aspects of Nicaragua
[PB-207385] N72-27401

CADMIUM TELLURIDES
Cadmium telluride/mercury telluride photodiodes as onboard infrared detectors, noting hermetic sealing method
N72-27440

CALCIUM METABOLISM
Existence of hypocalcemic factor in human thyroids
[NASA-TT-F-14341] N72-27079

CALCULUS OF VARIATIONS
Solution of 0[3]-invariant Bethe-Salpeter equation and variational method for solving radial equation
[TR-72-111] N72-27622

CALIBRATING
Transonic wind tunnel calibration of dual system gust measuring probe
[ARL/A-NOTE-334] N72-27426
Calibration of thermocouples at melting point of platinum by small batch method
[AD-738748] N72-27474

CALIFORNIA
Environmental impact statement for Jet Propulsion Laboratory at Pasadena, California
[NASA-CR-127575] N72-27267
Discrimination of sodium D2 line in surficial desert and semidesert deposits of California and Arizona
[NASA-CR-127529] N72-27353

CALORIMETERS
Resistance thermometer coupled to data acquisition system for calorimeter temperature recording
[NLL-LIB-COMM-1656-[5196]] N72-27416
Calorimeter standard for determining energy of ion pair formation in air
[NLL-M-22434-[5828.4F]] N72-27417
Calorimeter for measuring thermal output of nickel cadmium batteries
[NASA-CASE-GSC-11434-1] N72-27430
Construction, calibration, and operation of Bunsen-type ice calorimeter
[AD-739186] N72-27475

CANADA
Magnetic observation tables for Resolute, Northwest Territories
[M70-43/5] N72-27339
Scientific research projects on lasers, surveillance, armaments, materials and weapon analysis
[DREV-666/72] N72-27982

CANONICAL FORMS
Canonical satellite theory based on independent variables different from time
[ESRO-CR-[P]-76] N72-27625

CAPACITANCE
Potential step and triangular voltage sweep methods in surface capacitance measurements on porous silver electrodes
[AD-739482] N72-27242
Automatic capacitance measurement system
[AD-739556] N72-27480
CAPACITORS
Surveys of capacitive transducers and their circuit design
[NASA-CR-127251] N72-27235
Selection criteria for capacitive transducer for distance measurement
[NASA-CR-127250] N72-27434
CAPE KENNEDY LAUNCH COMPLEX
Facilities and environmental measurements to be monitored in support of Apollo/Saturn vehicle AS-511
[NASA-TM-X-68517] N72-27261
Environmental impact statement of Apollo project based on ten Apollo spacecraft and Saturn 5 launch vehicle operations at Cape Kennedy Launch Complex, Florida
[NASA-TM-X-68544] N72-27903
CARBIDES
Wear resistance of chrome vanadium steels and dependence on distribution of alloying elements in martensite and carbides
[AD-739276] N72-27581
Role of carbide morphology on low cycle fatigue behavior of iron-carbon alloys
[AD-739508] N72-27592
CARBON
Activity and solubility of carbon in austenitic chromium-nickel steels with approximately 18 percent Cr at temperatures between 950 and 1200 C
[NLL-CE-TRANS-5881-[9022.09]] N72-27561
CARBON DIOXIDE LASERS
Characteristics of pulsed carbon dioxide laser and methods for producing powerful ultrashort pulse of laser emission
[NLL-DRIC-TRANS-2644-[3623.66]] N72-27547
Development and characteristics of power supply for carbon dioxide laser
[NASA-CASE-GSC-11222-1] N72-27548
Development of discharge tubes with various metal components to determine suitable material for cold cathode of carbon dioxide laser
[NASA-CR-122441] N72-27550
CARBON DIOXIDE REMOVAL
Carbon dioxide- and thermal-control in regenerative life support system for extravehicular human protection during advanced space missions N72-27114
CARBON FIBERS
Formation of rigid carbon fibers from COOH containing rayon fiber pyrolysis
[AD-739284] N72-27605
CARBON STEELS
Derivation of equation to predict rolling-element fatigue lives of through-hardened bearing steels combining effects of material hardness, carbide factor, and bearing temperature
[NASA-TM-X-68078] N72-27573
CARBONIZATION
Carbonization and thermal transformations of carbo- and hetero-chain polymers
[NLL-RTS-7032] N72-27142
CARDIOVASCULAR SYSTEM
Comparing effects of positive Gy acceleration on cardiovascular and respiratory functions in dogs under normal respiration in air, and when totally immersed in oxygenated fluorocarbon
[NASA-CR-127262] N72-27078
Effects of bromotrifluoromethane inhalation and epinephrine challenge on cardiovascular system
[AD-739699] N72-27098
CASCADE FLOW
Cold air performance of annular nozzle cascade on transonic axial flow turbine
[NAL-TR-272] N72-27823
CASTING
Naturally and induced magnetohydrodynamic effects in casting processes
[PB-207429] N72-27544
CATALYSTS
Catalytic effect of cobalt powder on sodium chlorate candles as source of oxygen N72-27131
CATHODES
Cathode with insulating material for electrolytic brush polishing of metal surfaces
[NLL-T-1514-[9022.305]] N72-27488
Material transfer from electrodes during high vacuum pulse breakdown, using copper cathode
[AD-739208] N72-27744
CAUCHY PROBLEM
Approximation of abstract Cauchy problem, and its convergence
[NAL-TR-269T] N72-27619
CEMENTATION
Graphite particle cementation in electrically conductive fluidized bed
[NLL-TRANS-746-1149-[9022.401]] N72-27490
CENTER OF GRAVITY
Instrument for recording position of center of gravity projection in horizontal plane
[AD-739439] N72-27136
CENTRAL AMERICA
Geology, climatology, land use, and cadastral aspects of Nicaragua
[PB-207385] N72-27401
CENTRIFUGAL PUMPS
Two dimensional solutions for three dimensional velocity calculation on turbomachine centrifugal impeller flow
[NASA-TM-X-67959] N72-27720
CERAMICS
Liquid environment effect on ceramics fracture toughness noting plastic flow induction
[WB-5/71] N72-27956
CERENKOV RADIATION
Feasibility of Cerenkov laser to achieve broadly tunable laser action in ultraviolet region and beyond
[AD-739377] N72-27553
CERIUM
Effects of cerium additions on ductility, brittle fracture, and strength of low alloy normalized steels
[NLL-T-518-[9022.305]] N72-27565
CESIUM DIODES
Tungsten-rhenium electrode performance in cesium thermionic converters
[NASA-TM-X-68091] N72-27722
CESSNA AIRCRAFT
Investigation of midair collision of Boeing 707 commercial aircraft and Cessna 150 near Edison, New Jersey on 9 January, 1971
[NTSB-AAR-72-16] N72-27025
CHANNEL FLOW
Sound ray theory for analyzing effects of horizontal gradients on acoustic wave propagation velocity in channels N72-27727
CHARGED PARTICLES
Monoenergetic charged particle beam studies, using time of flight spectrometers
[AD-739189] N72-27827
Models for charged particle populations of Jupiter trapped radiation belts N72-27875
CHECKOUT
Establishment of criteria for design of onboard monitoring and checkout equipment for use with space shuttle propulsion system - Vol. 1
[NASA-CR-123712] N72-27911
CHEMICAL ANALYSIS
Gas chromatography and chelation for metal trace determinations in water and human body
[AD-739865] N72-27166
Characteristics and applications of industrial photometers for analyzing constituent parts of liquid and gaseous mixtures
[NLL-SMRE-TRANS-5691-[8313.4]] N72-27414
CHEMICAL ENGINEERING
Parameter identification for dynamic adaptive control
[AD-739525] N72-27627
CHEMICAL PROPERTIES
Discussion of aircraft fuels and lubricants to include production, analysis, testing and fire safety
[AGARD-AR-44] N72-27811
CHEMICAL PROPULSION
Japanese research and development progress in energy conversion and chemical propulsion
[AD-739325] N72-27067
Use of electrostatic ion propulsion with nuclear power generation for interplanetary spacecraft and comparison to chemical and nuclear propulsion
[DLR-FB-72-18] N72-27826
CHEMICAL REACTIONS
Active transport of Na and K ions and reaction mechanism for ATP-ase
[NLL-RTS-6898] N72-27075
Computer program for chemical reaction kinetics and transient states
[P-4812] N72-27157
CHLORATES
Catalytic effect of cobalt powder on sodium chlorate candles as source of oxygen N72-27131
CHOLINESTERASE
Cholinesterase methods for assaying pesticide poisoning in blood of aerial applicator personnel
[FAA-AM-72-12] N72-27080
CHROMATOGRAPHY
Optimal quantization of chromatographic function based on Gaussian distribution
[NLL-TRANS-836-[9022.64]] N72-27143
CHROMIUM
Effect of diamond burnishing on quality of chromium coatings
[AD-739206] N72-27607
CHROMIUM ALLOYS
Effect of different niobium contents on microstructure and degree of dispersion hardening of cast Cr-Ni alloys including effect of supplementary Mo alloying
[NLL-TRANS-746-1143-[9022.401]] N72-27567
Analysis of conditions producing superplasticity in nickel-chromium eutectic alloy
[NLL-TRANS-746-1185-[9022.401]] N72-27568
X ray photography used to obtain thermal expansion data for nickel-chromium alloys
[AD-739301] N72-27588
Composite materials of nickel-chromium matrix and molybdenum-tungsten reinforcing fibers
[NLL-TRAS-746-1190-[9022.401]] N72-27597
CHROMIUM STEELS
Activity and solubility of carbon in austenitic chromium-nickel steels with approximately 18 percent Cr at temperatures between 950 and 1200 C
[NLL-CE-TRANS-5881-[9022.09]] N72-27561
CHROMOSPHERE
Specifications of multichannel solar spectrometer onboard OSO-1, noting experimental design N72-27457
CIRCUIT DIAGRAMS
Surveys of capacitive transducers and their circuit design
[NASA-CR-127251] N72-27235
Precision surface cutter for screen circuit negatives and other microcircuits
[NASA-CASE-XLA-09843] N72-27485
CIRCUIT RELIABILITY
Feasibility of prediction models for estimating reliability of large scale integration microcircuits
[NASA-CR-123714] N72-27515
CIRCUITS
Four-phase tube generators for excitation of circuits shaping high frequency fields of configurations used in plasma physics research
[JPRS-56371] N72-27254
Precision surface cutter for screen circuit negatives and other microcircuits
[NASA-CASE-XLA-09843] N72-27485
CIRCULAR ORBITS
Maps of predicted electron fluxes for ITOS-A/NOAA-1 circular orbit, 79 deg inclination, and 1463 km altitude
[NASA-TM-X-65917] N72-27357
Collective oscillations of spherically symmetric systems of gravitational particles rotating in circular trajectories
[NASA-TT-F-14413] N72-27751
CIRCULAR POLARIZATION
Jupiter decimetric data on brightness contour maps, emission centroid position, circular polarization and magnetic field strength, and Faraday rotation and thermal electron density N72-27861
CIRRUS CLOUDS
Time lapse cloud brightness data from ATS 3 and correlation of cirrus shield variations in time to rainfall rate in midlatitude storm complexes N72-27648
CLEAR AIR TURBULENCE
Effects of upper atmosphere turbulence on operation of supersonic transport aircraft and methods for advance detection of atmospheric turbulence
[NLL-M-22437-[5828.4F]] N72-27009
Weather predictions for Concorde test flights and problems of forecasting stratospheric temperature and clear air turbulence
[NLL-M-22439-[5828.4F]] N72-27638
CLIMATE
Atmospheric models for mesoscale and small scale effects which influence global climate and weather
[AD-739541] N72-27669
Effects of solar constant change on earth climate
[NLL-M-22455-[5828.4F]] N72-27830
CLIMATOLOGY
Geology, climatology, land use, and cadastral aspects of Nicaragua
[PB-207385] N72-27401
CLINICAL MEDICINE
Standarized treatment of decompression sickness occurring while diving under pressure
[AD-737700] N72-27088
Multichannel bioelectric control system for simulating neuromuscular movements and treating motor function disturbances
[NRC-TT-1552] N72-27134
CLOSED ECOLOGICAL SYSTEMS
Design of auxiliary survival shelter as portable life support system in mines N72-27115
CLOUD GLACIATION
Microphysical diffusion model of rapid glaciation in supercooled clouds for studying precipitation from artificial seeding of layer-type orographic clouds
[TN-42] N72-27643
CLOUD PHOTOGRAPHY
Environmental impact statement for TIROS program
[NASA-TM-X-68551] N72-27907
CLOUD PHYSICS
Droplet size and concentration, and liquid water content of altostratus, altocumulus, and middle level accessory clouds
[TN-43] N72-27644

CLOUD SEEDING
Microphysical diffusion model of rapid glaciation in supercooled clouds for studying precipitation from artificial seeding of layer-type orographic clouds
[TN-42] N72-27643
Weather modification research and development by Navy
[AD-739364] N72-27667

CLOUDS
Motion of artificial ionized and luminous clouds in upper ionosphere
N72-27377
Development and characteristics of apparatus for measuring intensity of electric field in atmosphere
[NASA-CASE-KSC-10730-1] N72-27431

CLOUDS [METEOROLOGY]
Development and characteristics of apparatus for measuring intensity of electric field in atmosphere
[NASA-CASE-KSC-10730-1] N72-27431
Interactive man-computer system for measuring cloud motion from ATS pictures
N72-27647
Relationship between cloud brightness, rainfall, and runoff in Surinam
N72-27649
Use of geostationary satellite pictures for observation of tropical convective ensembles or cloud clusters
N72-27652

CLUTTER
Statistical analysis of ground and weather clutter data on magnetic digital tape recordings
[REPT-165] N72-27185
Statistical analysis of radar target and clutter data on magnetic digital tape recordings
[REPT-175] N72-27186

COATINGS
Boron atom diffusion in silicon coatings
[PUBL-884] N72-27600

COBALT COMPOUNDS
Pyromagnetic transition properties of cobalt-sulfur-selenium system
[AD-739336] N72-27798

CODING
Intasat satellite codification unit receiving data in digital and analog form
[NASA-TT-F-13899] N72-27171
Structural data coding method using numbered binary sequences
[NASA-TT-F-13895] N72-27172
Hydrological computer codes and algorithms for water management and snow surveys
[NLL-M-22339-[5828.4F]] N72-27342

COEFFICIENT OF FRICTION
Vibration frequency effect on coefficient of static friction
[AD-739279] N72-27535
Friction coefficent determination for plastic steel slide bearings
[AD-739212] N72-27538

COLD CATHODES
Development of discharge tubes with various metal components to determine suitable material for cold cathode of carbon dioxide laser
[NASA-CR-122441] N72-27550

COLD FLOW TESTS
Cold air performance of single stage axial flow turbine
[NAL-TR-273] N72-27822
Cold air performance of annular nozzle cascade on transonic axial flow turbine
[NAL-TR-272] N72-27823

COLLAPSE
Nonspherical perturbations of relativistic gravitational field in collapsing star
N72-27841

COLLISION AVOIDANCE
Development and characteristics of electronic signalling system and data processing equipment for warning system to avoid midair collisions between aircraft
[NASA-CASE-LAR-10717-1] N72-27703
Microwave interferometers used as radio eye for aircraft navigation and collision avoidance system including comparison of cost with present systems
[REPT-62] N72-27708

COLLISIONLESS PLASMAS
Electrostatic singularity in magnetic mirror field in collisionless plasma noting shock formation
[TRITA-EPP-72-10] N72-27777
Low temperature plasma transfer, including vapor diffusion of alkali metals
[AD-738739] N72-27781

COLOR
Pseudocolor separation process for gray interpretation in black and white conversion to chromatic image
[P-4804] N72-27738

COLOR PHOTOGRAPHY
Remote sensing of flood damage in vicinity of Rapid City, South Dakota using color and infrared imagery
[SDSU-RSI-72-11] N72-27368

COLOR TELEVISION
Construction and operation of superhigh frequency transmitter and receiver installation for color television system
[REPT-150] N72-27269

COLORADO
Environmental impact survey of hail in Colorado, Wyoming, and Nebraska
[PB-207539-F] N72-27661

COLORIMETRY
Precision measurements using colorimetry techniques to include spectrophotometry, reflectometry, metamerism, and tristimulus values - Vol. 9
[NBS-SP-300-VOL-9] N72-27524

COLUMNS [PROCESS ENGINEERING]
Operational efficiency of countercurrent continuous gas chromatograph with enlarged processing column
[NLL-RTS-6992] N72-27407

COMBUSTION
Vacuum thermal decomposition of combustion intermediates from reaction of N2O4 with N2H4
[AD-739187] N72-27163

COMBUSTION PHYSICS
Detonation characteristics of heterogeneous systems consisting of petroleum and oxygen contained in pipes
[NLL-298-[8660.5]] N72-27961

COMBUSTION PRODUCTS
Analysis of carbon monoxide, unburned hydrocarbons, and nitrogen oxides in turbojet afterburner combustion products using infrared spectroscopy - Part 1
[AD-739176] N72-27968
Computer program for determining history of combustion products produced by turbojet engine afterburner - Part 2
[AD-739177] N72-27969

COMMAND AND CONTROL
Design of command and control systems using decision and information theory
[AD-739708] N72-27201

COMMAND GUIDANCE
Development and numerical analysis of three-dimensional optimal explicit guidance system for space vehicles
[NAL-TR-258] N72-27931

COMMUNICATION CABLES
Development of procedure to prevent or arrest corrosion in communication cables buried in soil or underwater at Kennedy Space Center
[KSC-TM4-275-MI] N72-27916

COMMUNICATION SATELLITES
Microwave power amplifier and processing system for superhigh frequency transmission by Communications Technology Satellite
[NASA-TM-X-68106] N72-27177
Criteria for optimizing communication satellite transmission efficiency, noting lower and higher frequency predicted scintillations
[REPT-6-71] N72-27188
Ten-ampere switching transistor for use in traveling wave current supply and main control unit of telecommunication system in communications satellite
[NASA-TT-F-14338] N72-27229
Design of transmitter traveling wave tube for communication satellite
[AD-739542] N72-27244

COMMUNICATION THEORY
USSR development of cybernetics and information
[JPRS-56465] N72-27179

COMPLEX SYSTEMS
Synthesis of feedback systems with large plant ignorance for prescribed time domain tolerances
[NASA-CR-116779] N72-27253
Reliability analysis of parallel standby system
[AD-739477] N72-27542

COMPLEXITY
Effects of noise and illumination on human motor performance
[AD-739474] N72-27095

COMPONENT RELIABILITY
Reliability analysis of parallel standby system
[AD-739477] N72-27542

COMPOSITE MATERIALS
Development, stress analysis, and manufacturing of horizontal stabilizer for A-4 aircraft using graphite-epoxy laminates in primary structure
[AD-738900] N72-27040
Development of criteria for application of composite materials in construction of helicopter synchronizing drive shafts
[AD-739429] N72-27043
Development of composite structure for propeller blade retention on V/STOL aircraft propulsion system
[AD-739555] N72-27047
Inspection techniques for coated refractory metals and filamentary composites
N72-27518
Development of procedure for repairing fiberglass structures which retains geometry and strength of original structure
[NASA-CASE-LAR-10416-1] N72-27527
Production, application, and properties of polycrystalline metal whiskers used with composite materials
[NLL-TRANS-746-1106-[9022.401]]
N72-27555
Selection of intermediate layer material for application to production of corrosion-resistant bimetal
[NLL-TRANS-746-1147-[9022.401]]
N72-27559
Long term stability of Nichrome based heat resistant composite, reinforced with tungsten fibers
[NLL-TRANS-746-1148-[9022.401]]
N72-27596
Composite materials of nickel-chromium matrix and molybdenum-tungsten reinforcing fibers
[NLL-TRAS-746-1190-[9022.401]]
N72-27597
Applications, production, and physical properties of high temperature fiber composites
[NLL-TRANS-746-1195-[9022.401]]
N72-27599
Effect of aluminum carbide formation on mechanical properties of model carbon-aluminum composite
[ARL/MET-87] N72-27601

COMPRESSIBLE FLOW
Viscous compressible fluid flow in domain bounded by two coaxial, elastic cylindrical shells
N72-27309

COMPRESSION LOADS
Compressive stress effects on surface hardness of glazes
[NLL-T-1509-[9022.305]] N72-27595

COMPRESSION TESTS
Development of test apparatus for subjecting metal specimen to tensile and compressive loads at constant temperature
[NASA-CASE-LAR-10426-1] N72-27947

COMPRESSOR EFFICIENCY
Afterburning steady state performance and operational limits of TF-30 turbofan engine
[NASA-TN-D-6839] N72-27014

COMPRESSOR ROTORS
Thermal stress analysis on roller bearings in gas turbine compressor rotor
[AD-739209] N72-27537

COMPTON EFFECT
Fixed pole and Regge pole terms in formula for forward Compton scattering
[RIFP-148] N72-27760

COMPUTER DESIGN
Design of stored program computer for OAO 3
[NASA-TM-X-65937] N72-27211
Physical properties and costs of designing ultimate computer
[P-4825] N72-27212
Computer terminal network for transparent stimulation of user of on-line retrieval system
[NBS-TN-732] N72-27217

COMPUTER GRAPHICS
Interactive graphics for structural languages and biological waveform analysis, using special purpose computers
[AD-739258] N72-27135
FORTRAN extended graph algorithmic language for Univac 1108
[NASA-CR-127263] N72-27206
Computerized graph techniques based on algorithms with several applications including molecular structures and networks
[REPT-127] N72-27221

COMPUTER PROGRAMMING
Computer program for chemical reaction kinetics and transient states
[P-4812] N72-27157
Operational application of computerized systems to agrometeorology
[NLL-M-22337-[5828.4F]] N72-27631
Air traffic control procedures for aircraft carrier operations based on trajectory optimization and computer-aided reassignment
[AD-739713] N72-27713
Computer programming for analysis of Explorer 34 magnetic field data
[NASA-TM-X-63086] N72-27894

COMPUTER PROGRAMS
Computer programs for analyzing electromagnetic radiation fields of bent thin wire antennas and scatterers
[AD-739203] N72-27190
Detailed program description portion of user manual for computer programs relating to electromagnetic interference prediction and analysis process - Part 1
[AD-739526] N72-27196
Detailed program description portion of user manual for computer programs relating to electromagnetic interference prediction and analysis process - Part 2
[AD-739527] N72-27197
Logic flow diagrams and glossary of computer symbols portion of user manual for computer programs relating to electromagnetic interference prediction and analysis process - Part 2
[AD-739529] N72-27199
Logic flow diagrams and glossary of computer symbols portion of user manual for computer programs relating to electromagnetic interference prediction and analysis process - Part 3
[AD-739530] N72-27200
Computer program for coordinates, incompressible inviscid section characteristics, and two dimensional drag-rise for NACA airfoils
[AD-738623] N72-27332
Thruster attitude control simulation for designing and evaluating reaction control system
[NASA-TM-X-64660] N72-27815

Computer program for determining history of combustion products produced by turbojet engine afterburner - Part 2
[AD-739177] N72-27969

COMPUTER SYSTEMS PROGRAMS
Pattern recognition computer networks for layered input transformation processing
[NASA-CR-127266] N72-27208
Computer systems designed for simulating large complex systems
[P-4791] N72-27214

COMPUTER TECHNIQUES
Computer technique for data reduction and correction in quantitative electron probe microanalysis
[NBS-TN-719] N72-27209
Computer recognition of speech signals
[JPRS-56370] N72-27210
Automatic methods based on computers for processing hydrochemical data for USSR hydrometeorological service
[NLL-M-22307-[5828.4F]] N72-27270
Hydrological computer codes and algorithms for water management and snow surveys
[NLL-M-22339-[5828.4F]] N72-27342
Computer processing of hydrological gauge data
[NLL-M-22341-[5828.4F]] N72-27343

COMPUTERIZED SIMULATION
Computer aided analysis of electric and fluid fields in electrofluid dynamic generators
[AD-739547] N72-27070
Modifying Siegel-WoL operator simulation model for on-line operation
[AD-737798] N72-27138
Virtual measure variance reduction technique in computer simulation
[P-4817] N72-27213
Computer systems designed for simulating large complex systems
[P-4791] N72-27214
Mission requirements for air to air missile and digital computer program to synthesize requirements into preliminary design
N72-27682
Analysis of digital and analog computer techniques for simulation of missile guidance and control and application of hybrid simulation procedures
N72-27687
Thruster attitude control simulation for designing and evaluating reaction control system
[NASA-TM-X-64660] N72-27815

COMPUTERS
Logic flow diagrams and glossary of computer symbols portion of user manual for computer programs relating to electromagnetic interference prediction and analysis process - Part 1
[AD-739528] N72-27198
Computer network and systems software development
[AD-739705] N72-27225
Use of computers for hydrological research
[NLL-M-22333-[5828.4F]] N72-27340
Two-channel constant-temperature hot-wire anemometer and mean-product computer
[AD-739337] N72-27655

CONCORDE AIRCRAFT
Weather predictions for Concorde test flights and problems of forecasting stratospheric temperature and clear air turbulence
[NLL-M-22439-[5828.4F]] N72-27638

CONDUCTION
Electron conduction in glass and preparation of conducting glasses
[NLL-TRANS-852-[9022.64]] N72-27598

CONES
Location of laminar-turbulent transition in wake of 22-deg half angle sharp cones at hypersonic speed
[AD-739318] N72-27326
Empirical formulas for aerodynamic coefficients of blunted cones in rarefied gas
[AD-739214] N72-27331

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Nickel cadmium batteries for aerospace application including materials, pre-charge, and thermal problems - 1971 NASA/Goddard-Aerospace Industry Battery Workshop
[NASA-TM-X-68829] N72-27062
Conference on portable life support systems for human protection
[NASA-SP-302] N72-27106
Hearing, bioacoustics, and biomechanics for biodynamic models - conference
[AD-739501] N72-27140
Titles and authors of reports from Second Scientific Technical Conference on Radio Communication
[NASA-TT-F-14406] N72-27169
Numerical analysis of one, two, and three dimensional fluid flow - conferences
[AGARD-LS-48] N72-27293
Onboard optical equipment, radiation sources and detectors for aerospace environments - conferences
N72-27435
Conference on improving welded product design
N72-27491
Discussions on papers presented at conference on improving design of welded products
N72-27511
Proceedings of conference on principles of strapdown inertial navigation platforms
[NASA-CR-123710] N72-27673
Conference papers on solid state physics
[AD-739691] N72-27808
Jupiter radiation belt models, radiation effects, earth-based observations of Jupiter magnetosphere, and Pioneer F and G missions - conference
[NASA-CR-127124] N72-27850
Proceedings of conference on weights and measures conducted by National Bureau of Standards in July 1971
[NBS-SP-358] N72-27975

CONFORMAL MAPPING
Set of general properties for conformal covariant theories
[NOTA-INTERNA-361] N72-27624

CONGRESS
Congressional appropriation in response to fiscal year 1973 budget requests submitted by HUD, NASA, NSF, and VA
[S-REPT-92-820] N72-27973
Congressional appropriations hearings for fiscal year 1973 funds required by HUD, NASA, NSF, and VA
[H-REPT-92-1071] N72-27974
Congressional hearings to determine fiscal year 1973 funding of HUD, NASA, NSF, VA, and several independent committees
N72-27977

CONICAL BODIES
Jet effects on boattail drag of nozzles with truncated conical bodies at supersonic speed and varying ratios of boattail length to maximum diameter
[NASA-TN-D-6789] N72-26997

CONICAL SHELLS
Application of finite element method for analyzing bending stiffness of cylindrical shells and truncated conical shell
[NAL-TR-262] N72-27952

CONSERVATION EQUATIONS
Simple classical mechanical model for reactive scattering of atom and quasi-diatomic molecule using conservation relations
[NASA-CR-127260] N72-27756

CONSERVATION LAWS
Conservation laws and preferred frames in relativistic gravity
[NASA-CR-127277] N72-27358

CONSTANTS
Bounded coupling constants in field theory with one space and one time dimension
[TR-73-003] N72-27764

CONSTITUTIVE EQUATIONS
Characteristic equations in generalized curvilinear tensor form for solving elastic wave propagation problems
[NASA-CR-127122] N72-27176

CONSTRAINTS
Aircraft accident investigations of crashes of agricultural aircraft and effectiveness of protective equipment in preventing injuries and fatalities
[FAA-AM-72-15] N72-27011

CONSTRUCTION MATERIALS
Nuclear radiation effects on Saturn 5 materials and design of reusable nuclear shuttle
[NASA-CR-2045] N72-27717
Nuclear heating effects on propellant and structures of reusable nuclear shuttle configuration
[NASA-CR-2042] N72-27718

CONTINENTAL SHELVES
Subbottom acoustic reflection from continental shelf off Venezuela
[PB-207597] N72-27392

CONTINUITY [MATHEMATICS]
Binary coding of continuous time communications
[NASA-TT-F-13896] N72-27207

CONTINUUM MECHANICS
Hybrid computers and digital simulation languages for continuous system dynamics analysis
[NASA-CR-127252] N72-27220

CONTROL SIMULATION
Analysis of digital and analog computer techniques for simulation of missile guidance and control and application of hybrid simulation procedures
N72-27687

CONTROL THEORY
Control system analysis for mathematical modeling of respiratory protective devices
N72-27128

CONTROLLABILITY
Statistical analysis of XB-70 aircraft responses and control inputs
[NASA-TN-D-6872] N72-27013

CONVECTION
Convection and mixing of stratified fluid in rotating container for Apollo spacecraft
[NASA-TR-R-386] N72-27313
Use of geostationary satellite pictures for observation of tropical convective ensembles or cloud clusters
N72-27652

CONVECTIVE HEAT TRANSFER
Analog computer methods used to determine convective heat and mass transfer from water surfaces
[PB-207638] N72-27660

CONVERGENCE
Approximation of abstract Cauchy problem, and its convergence
[NAL-TR-269T] N72-27619

CONVOLUTION INTEGRALS
Learning decoders for decoding compatible convolutional codes
[NASA-CASE-MSC-14070-1] N72-27178

COOLING
Indirect heat conduction cooling of superconducting Ni-Ti stabilized magnet coils
[DESY-71/57] N72-27794

COOLING SYSTEMS
Flow characteristics of turbine airfoil cooling system components
[NASA-CR-120883] N72-27290

COORDINATE TRANSFORMATIONS
Aircraft position and motion controlled by photogrammetric three reference point method noting coordinate transformations
[SAAB-TN-68] N72-27472

COORDINATES
System for locating lightning strokes by coordination of directional antenna signals
[NASA-CASE-KSC-10729-1] N72-27234

COPPER ALLOYS
Uniform elongation and work hardening of sheet and spherical aluminum and copper alloys, brass, and steel
[NLL-TRANS-746-1121-[9022.401]] N72-27557

CORE SAMPLING
Program summary for development of moderate depth lunar drill
[NASA-CR-123724] N72-27526

CORNERS
Finite difference solutions to Navier-Stokes equations for laminar supersonic flow over flat plate and compression corner
[NASA-TR-R-385] N72-27311

CORROSION
Dissolution behavior of metallic oxides and iron base compounds in aqueous solutions
[AD-739395] N72-27590

CORROSION PREVENTION
Corrosion inhibiting properties of epoxy primers used in aluminum alloys
[AD-738446] N72-27606
Development of procedure to prevent or arrest corrosion in communication cables buried in soil or underwater at Kennedy Space Center
[KSC-TM4-275-MI] N72-27916

CORROSION RESISTANCE
Selection of intermediate layer material for application to production of corrosion-resistant bimetal
[NLL-TRANS-746-1147-[9022.401]] N72-27559

CORROSION TESTS
Mechanism, extent, and testing of galvanic corrosion of metals
[NLL-TRANS-746-1174-[9022.401]] N72-27147

COSMIC RAYS
Interactions of nucleons bound in heavy nuclei with high energy cosmic rays
[NASA-TT-F-14409] N72-27832
Diffusion model for energy dependence of electron anisotropy in cosmic rays
[RM-548] N72-27838
Proton fluxes in Jupiter magnetosphere from cosmic ray albedo neutron decay
N72-27866

COSMOS SATELLITES
Combined analysis of data on radiometric satellite and wind waves from Cosmos 243
[NASA-TT-F-14400] N72-27170
Optical satellite tracking of Cosmos and other artificial satellites, Edinburgh, Feb. 1972
[ROE-STS-123] N72-27936
Optical satellite tracking of Cosmos and other artificial satellites, Edinburgh, Mar. 1972
[ROE-STS-124] N72-27937

COSMOS 381 SATELLITE
Ground based reception of Cosmos-381 satellite signals from magnetically conjugate domain
N72-27180

COST ANALYSIS
Physical properties and costs of designing ultimate computer
[P-4825] N72-27212
Large space program cost savings from low cost, refurbishable, and standard spacecraft
[NASA-CR-127117] N72-27913

COST EFFECTIVENESS
Numerical determination of optimal control strategies for air quality standards and regulatory policy with minimum economic impact of implementation
[PB-207975] N72-27671

COST ESTIMATES
Microwave interferometers used as radio eye for aircraft navigation and collision avoidance system including comparison of cost with present systems
[REPT-62] N72-27708
Procurement research and cost estimates of DOD and NASA
[AD-738983] N72-27987

COST REDUCTION
Design and fabrication of low cost turbojet and turbofan engines
[NASA-TM-X-68085] N72-27816

COSTS
Design codes which determine quality and overall cost of pressure vessels constructed in carbon and carbon-manganese steel
N72-27492

COUPLING
Electric coupling between magnetosphere and ionosphere noting time dependent fields, substorms, auroral arcs and double layers
[TRITA-EPP-72-11] N72-27385

COVARIANCE
Set of general properties for conformal covariant theories
[NOTA-INTERNA-361] N72-27624

CRACK INITIATION
Analyzing failure of welded structures to determine design criteria for preventing brittle fracture initiation
N72-27495

CRACK PROPAGATION
Fatigue strength and crack propagation in welded joints
[AD-739341] N72-27540
Application of impulsive step function technique for solving boundary value problem of elliptic cylindrical cavity in infinite solid
[TAE-148] N72-27951
Fatigue crack propagation in Fokker F-28 full-scale wing structure under cyclic gust flight simulation loading
[NLR-TR-71043-U] N72-27955
Analysis of stress intensity factor of half-plane crack extending non-uniformly in isotopic elastic solid subjected to general loading
[AD-739557] N72-27957

CRACKING (FRACTURING)
Correlation of abrasion, microindentation hardness and maximum fracture velocity of optical glasses in liquids
[WB-2/71] N72-27603

CREEP RUPTURE STRENGTH
Relation between creep rupture strength and electron microstructure of Cr-Mo steels after heat treatment
[NLL-CE-TRANS-5594-[9022.09]]
N72-27560
Stress rupture tests of brazed joints at elevated temperatures with emphasis on effects of oxidation
[NLL-LTI-746-1165-[9022.401]]
N72-27941

CRITICAL FREQUENCIES
Ionospheric propagation data for E and F regions, India - Sept. 1970
[RTRC-A184] N72-27373
Ionospheric propagation data for E and F regions, India - Aug. 1970
[RTRC-A183] N72-27374

CROSS FLOW
Periodic crossflow effects on heat transfer in laminar axisymmetric boundary layer
[TAE-146] N72-27320

CROSSED FIELD AMPLIFIERS
Life tests on crossed field amplifiers
[AD-738458] N72-27236

CRYOGENIC EQUIPMENT
Cryogenic and liquid metal technology applications in industry and for ground transportation
[NASA-TM-X-68092] N72-27737

CRYOGENIC GYROSCOPES
Cryogenic gyroscope housing with annular disks for gas spin-up
[NASA-CASE-MFS-21136-1] N72-27731

CRYOGENIC STORAGE
Evaluation of model shadow shield thermal protection system and support members for possible application to shielding of cryogenic tanks to reduce heat transfer
[NASA-TM-X-68099] N72-27966

CRYOGENICS
Josephson junction amplifier performance
[AD-739383] N72-27243
Cryogenic properties of solids, slush hydrogen heat transfer, and solid hydrogen
[NASA-CR-127275] N72-27730

CRYSTAL DEFECTS
Degradation of optical materials in aerospace environments noting point defects induced by ionizing radiation or charged particle collision
N72-27455
Stacking fault effects on bounded ultrasonic surface waves in liquid-solid interface
[AD-739703] N72-27748

CRYSTAL DISLOCATIONS
Crystal dislocations and vacancy movement
[NLL-M-21377-[5828.4F]] N72-27787

CRYSTAL GROWTH
Optical and electron microscopic examination of metallic Nichrome matrix grain growth behavior during annealing
[NLL-TRANS-746-1173-[9022.401]]
N72-27563
Ice crystal terminal velocities for calculating ice crystal growth in clouds, evaporation in subcloud regions, and precipitation rates
[NASA-CR-127428] N72-27645
Growth of single crystals of mixed titanates and tungstates
[NASA-CR-120949] N72-27792
Czochralski technique for improving growth and characterization of GaAs and mixed III and V semiconductor crystals
[AD-739374] N72-27807

CRYSTAL LATTICES
Conversions in Pt-Fe system, and proof of super lattices Fe3Pt and FePt3
[NASA-TT-F-14320] N72-27576

CRYSTAL STRUCTURE
Production, application, and properties of polycrystalline metal whiskers used with composite materials
[NLL-TRANS-746-1106-[9022.401]]
N72-27555
Temperature dependence of speed of sound and crystal structure of molten metals
[NLL-M-21371-[5828.4F]] N72-27788

CUMULUS CLOUDS
Droplet size and concentration, and liquid water content of altostratus, altocumulus, and middle level accessory clouds
[TN-43] N72-27644

CUTTERS
Precision surface cutter for screen circuit negatives and other microcircuits
[NASA-CASE-XLA-09843] N72-27485

CYBERNETICS
USSR development of cybernetics and information
[JPRS-56465] N72-27179

CYCLOIDS
Hydromechanical perturbation theory for cycloidal propellers
N72-27285

CYLINDRICAL CHAMBERS
Numerical solution of thermal conductivity for hollow cylinders by application of Green functions
[NLL-WH-TRANS-325-[9091.9F]]
N72-27963

CYLINDRICAL SHELLS
Viscous compressible fluid flow in domain bounded by two coaxial, elastic cylindrical shells
N72-27309
Deep-drawing and stretch forming behavior of steel in shaping large cylindrical cups
[NLL-TRANS-746-1152-[9022.401]]
N72-27483
Application of finite element method for analyzing bending stiffness of cylindrical shells and truncated conical shell
[NAL-TR-262] N72-27952
Application of hybrid finite element method for analyzing vibration properties of cylindrical shells
N72-27954

CZOCHRALSKI METHOD
Czochralski technique for improving growth and characterization of GaAs and mixed III and V semiconductor crystals
[AD-739374] N72-27807

D

DAMPING
Solar abundance of iron and damping constant
N72-27843

DATA ACQUISITION
Automatic data acquisition and processing for seismological station
[AD-739172] N72-27398

DATA PROCESSING
Statistical covariance technique for computerized error analysis on missile tracking system
[AD-739513] N72-27223
Computer network and systems software development
[AD-739705] N72-27225
Automatic methods based on computers for processing hydrochemical data for USSR hydrometeorological service
[NLL-M-22307-[5828.4F]] N72-27270
Automated data processing for hydrological research
[NLL-M-22344-[5828.4F]] N72-27341
Automatic data acquisition and processing for seismological station
[AD-739172] N72-27398
Operational application of computerized systems to agrometeorology
[NLL-M-22337-[5828.4F]] N72-27631
Computer analysis and numerical weather forecasting
[TT-70-50185] N72-27659

DATA PROCESSING EQUIPMENT
Resistance thermometer coupled to data acquisition system for calorimeter temperature recording
[NLL-LIB-COMM-1656-[5196]] N72-27416

DATA RECORDERS
Statistical analysis of ground and weather clutter data on magnetic digital tape recordings
[REPT-165] N72-27185
Statistical analysis of radar target and clutter data on magnetic digital tape recordings
[REPT-175] N72-27186

DATA REDUCTION
Computer technique for data reduction and correction in quantitative electron probe microanalysis
[NBS-TN-719] N72-27209
Virtual measure variance reduction technique in computer simulation
[P-4817] N72-27213
Computer processing of hydrological gauge data
[NLL-M-22341-[5828.4F]] N72-27343
Data reductation and spacecraft position determination used in two ATS experiments
[NASA-TM-X-65920] N72-27885
Computer programming for analysis of Explorer 34 magnetic field data
[NASA-TM-X-63086] N72-27894

DATA STORAGE
Data storage system with vidicon tube for electrical input/output signal processing
[NASA-CASE-MSC-14053-1] N72-27215

DATA SYSTEMS
Computer network and systems software development
[AD-739705] N72-27225
Integrated circuits and semiconductors for data processing systems
[AD-739548] N72-27258

DE HAVILLAND AIRCRAFT
Noise environment of C-7A during ground and airborne operation
[AD-738627] N72-27086

DECAMETRIC WAVES
Jupiter decametric radiation data on burst sources, frequency drift rates, Io influence, magnetic field strength, and plasmapause location
N72-27860

DECIMETER WAVES
Jupiter decimetric data on brightness contour maps, emission centroid position, circular polarization and magnetic field strength, and Faraday rotation and thermal electron density
N72-27861

DECISION MAKING
Procedures for determining capacity of air traffic control systems and application to long range planning, management decisions, and system performance evaluation
[AD-738892] N72-27710

DECODERS
Learning decoders for decoding compatible convolutional codes
[NASA-CASE-MSC-14070-1] N72-27178

DECOMPRESSION SICKNESS
Standarized treatment of decompression sickness occurring while diving under pressure
[AD-737700] N72-27088
Design of portable decompression chamber with semiclosed gas recirculation system for treating underwater divers
N72-27116

DECONTAMINATION
Langmuir probe surface contamination noting plasma jet simulation, decontamination methods, and material selection
[ESRO-SN-115-ESTEC] N72-27531

DEFENSE PROGRAM
Procurement research and cost estimates of DOD and NASA
[AD-738983] N72-27987
Aircraft engine maintenance, military training, and antiaircraft defense
[AD-739974] N72-27991

DEFLECTION
Numerical analyses of large amplitude vibrations of thin elastic plates and shallow shells under random excitation and limiting boundary conditions
[AD-739976] N72-27958

DEFORMATION
Discontinuous deformation as function of strain rate and temperature in spherulitic graphite iron
[NLL-TRANS-746-1167-[9022.401]]
N72-27562
Stress-relaxation tests of ferritic iron samples to determine plastic deformation processes occurring in stressed material due to thermal energy
[NLL-TRANS-746-1168-[9022.401]]
N72-27942

DEGASSING
Solubility and diffusion in titanium-aluminum-hydrogen systems, and degasification due to titanium
[NLL-294-[8660.5]] N72-27570

DEGRADATION
Degradation of optical materials in aerospace environments noting point defects induced by ionizing radiation or charged particle collision
N72-27455
Onboard optical system degradation prediction by space environment simulation
N72-27456

DEGREES OF FREEDOM
Development of frequency model for single degree of freedom rate integrating gyroscope using Eulerian formulation
[AD-739182] N72-27711

DEIMOS
Satellite rendezvous, landing, and roving mission to Phobos and Deimos
[NASA-CR-112077-2] N72-27877
Objectives, payloads, sampling, and return for Phobos/Deimos mission
[NASA-CR-112077-3] N72-27878
Combined mission planning for flights to Mars and Phobos/Deimos
[NASA-CR-112077-4] N72-27879

DELAY LINES
Electrical characteristics of spiral groove delay system for centimeter wave band
[JPRS-56385] N72-27175

DELTA WINGS
Hypersonic wind tunnel tests on delta wing models at high incidence for pressure distribution determination
[ARC-CP-1198] N72-27004
Wind tunnel tests to determine static longitudinal and lateral-directional aerodynamic effects of various configuration changes on parametric delta wing orbiter
[NASA-CR-123722] N72-27923

DENSITY DISTRIBUTION
Approximate shock wave model for studying radial density distribution and refractive index in wake of shell in hypersonic flight
[ISL-16/71] N72-27323
Pseudocolor separation process for gray interpretation in black and white conversion to chromatic image
[P-4804] N72-27738

DENSITY MEASUREMENT
Precursor electron and ion densities ahead of ionizing shock waves
[CP-31] N72-27775

DESERTS
Discrimination of sodium D2 line in surficial desert and semidesert deposits of California and Arizona
[NASA-CR-127529] N72-27353

DETECTION
Detection thresholds of seismic observatory
[AD-739173] N72-27397

DETECTORS
Lithium-drifted silicon detectors, fission cell, electron flux detectors, and semiconductor devices
[NASA-CR-127267] N72-27847

DETONATION
Detonation characteristics of heterogeneous systems consisting of petroleum and oxygen contained in pipes
[NLL-298-[8660.5]] N72-27961

DIATOMIC MOLECULES
Transition amplitudes of multiphoton excitations of vibrational rotational states in diatomic molecules in intense electromagnetic fields
[NASA-CR-127419] N72-27761

DIFFERENCE EQUATIONS
Approximations for difference problem with oblique derivitive in half plane
[NASA-TT-F-14346] N72-27617

DIFFERENTIAL AMPLIFIERS
All-pass networks with Wien bridge and differential amplifier
[NLL-TRANS-2850-[9022.81]] N72-27248

DIFFERENTIAL CALCULUS
Implicit differential method for laminar, incompressible, steady state boundary layer
[NASA-TT-F-14363] N72-27314

DIFFERENTIAL EQUATIONS
Trajectory computations in FORTRAN for engineering-type application, using differential equations
[NASA-TM-X-64679] N72-27891

DIFFERENTIAL INTERFEROMETRY
Shock tube hypersonic gas flow measurements using helium-neon laser differential interferometer
[ISL-14/71] N72-27324

DIFFUSION
Solubility and diffusion in titanium-aluminum-hydrogen systems, and degasification due to titanium
[NLL-294-[8660.5]] N72-27570
Boron atom diffusion in silicon coatings
[PUBL-884] N72-27600

DIFFUSION COEFFICIENT
Viscosity coefficient characterization by mass or heat diffusion coefficients
[NLL-T-1507-[9022.305]] N72-27289

DIGITAL COMPUTERS
Monitoring circuitry design for self repairing computer
[AD-739417] N72-27224

DIGITAL DATA
Intasat satellite codification unit receiving data in digital and analog form
[NASA-TT-F-13899] N72-27171

DIGITAL SIMULATION
Hybrid computers and digital simulation languages for continuous system dynamics analysis
[NASA-CR-127252] N72-27220

DIGITAL SYSTEMS
Microelectronic integrated circuits for control of Canopus tracker
[NASA-CR-127418] N72-27251
Modification of conventional digital frequency divider to extend frequency range
[NASA-CASE-LAR-10730-1] N72-27255
Analysis of equipment necessary to set up digital fluidics systems laboratory
[AD-739430] N72-27476

DIGITAL TO ANALOG CONVERTERS
Converter modules for underwater to surface guided missiles
[AD-739248] N72-27222
Positioning device using mechanical drive [bevel gears] as digital to analog converter
[REPT-57] N72-27532

DIMENSIONLESS NUMBERS
Scale analysis with consideration of filtering and approximation of hydrothermodynamic equations for different meteorological scales
[NLL-M-22384-[5828.4F]] N72-27634

DIODES
Solid state microwave oscillator and amplifier development
[AD-739543] N72-27259

DIRECT CURRENT
Feedback controlled dc to dc converter with input/output isolation for voltage regulation
[NASA-CASE-HQN-10792-1] N72-27230
Isolated dc amplifier for bioelectric measurements
[NASA-CASE-ARC-10596-1] N72-27233

DISCRETE FUNCTIONS
Decomposition of random sequence formed by discretization of continuous stationary random process in terms of column vectors of normalized Hadamard matrix
[NASA-TT-F-13897] N72-27616

DISLOCATIONS [MATERIALS]
Hydrogen-dislocation interactions in alpha titanium aluminum alloys studied via internal friction measurements at high temperatures
[AD-739696] N72-27593

DISPLAY DEVICES
Operating procedure and controls and indicators for data compression/error correction digital test system
[NASA-CR-115643] N72-27219
Comparing visual and auditory displays when used as dynamic tri-level condition displays for electronic checkout
[AD-739475] N72-27477

DISSOCIATION
Tables of interpolation constants for calculation of transmittance and rate of dissociation of molecular oxygen in mesosphere and lower thermosphere
[NASA-TM-X-58084] N72-27349

DISTANCE MEASURING EQUIPMENT
Selection criteria for capacitive transducer for distance measurement
[NASA-CR-127250] N72-27434

DISTRIBUTION FUNCTIONS
Two particle distribution functions in pionization region of multiperipheral model
[TUEP-72-17] N72-27762

DIURNAL VARIATIONS
Heat balance equations for studying diurnal heat budget of thermosphere
[NASA-TM-X-65928] N72-27364
Relation between amount and depth of radiation inversions at night and diurnal range of air temperature at 2-m height in different USSR regions
[NLL-M-22336-[5828.4F]] N72-27630
Concentrations of small ions in air in open country, polluted site, fog, and enclosed room with artifical air conditioning
[NASA-TT-F-14408] N72-27642

DIVING [UNDERWATER]
Standarized treatment of decompression sickness occurring while diving under pressure
[AD-737700] N72-27088
Research in deep sea diving and lightning triggered by man
N72-27099
Development of deep sea diving technology
N72-27100
Design of gas mixture breathing systems for underwater diver equipment
N72-27108
Design of deep sea heavy duty diving equipment for salvage divers
N72-27118
Performance of closed circuit mixed gas underwater breathing apparatus
N72-27119
Diving suit and heat element combinations for thermal protection of underwater divers
N72-27120
Design and performance of prototype portable heat source for providing thermal insulation in diving suit
N72-27122

DOPPLER EFFECT
Horizontal gradients in ionospheric electron density and variations in Doppler frequency for satellite orbits
N72-27379

DOWNWASH
Application of downwash from helicopter rotors for dissipation of fog
[AD-739487] N72-27042

DRAG
Modulated force probe for drag coefficient measurements of spheres in hypersonic noncontinuum flow
[AD-739250] N72-27327

DRAG CHUTES
Design and development of spin-recovery parachute systems for military aircraft and compilation of design criteria
[NASA-TN-D-6866] N72-27033

DRAG MEASUREMENT
Jet effects on boattail drag of nozzles with truncated conical bodies at supersonic speed and varying ratios of boattail length to maximum diameter
[NASA-TN-D-6789] N72-26997

DRAG REDUCTION
Elastic boundary interaction with viscous sublayer of turbulent boundary layer flow for drag reduction
[NASA-TT-F-14391] N72-27315

DRAINAGE
Relationship between cloud brightness, rainfall, and runoff in Surinam
N72-27649

DRILLS
Program summary for development of moderate depth lunar drill
[NASA-CR-123724] N72-27526

DROP SIZE
Droplet size and concentration, and liquid water content of altostratus, altocumulus, and middle level accessory clouds
[TN-43] N72-27644

DROPS [LIQUIDS]
Spherical particle dissolution in spherical water drop governed by radial diffusion equation
[AD-739323] N72-27654

DUCTILITY
Plasticity and ductility of metals subjected to high pressure
[NLL-NEL-TT-2371-[6075.461]] N72-27564
Effects of cerium additions on ductility, brittle fracture, and strength of low alloy normalized steels
[NLL-T-518-[9022.305]] N72-27565

DUOCHROMATORS
Application of Fabry-Perot interferometers and duochromators to plasma diagnostics
[AD-738633] N72-27782

DUST COLLECTORS
Collection apparatus for sampling of small solid particles from atmosphere
[NASA-CASE-HQN-10037-1] N72-27424

DYNAMIC CHARACTERISTICS
Procedures for evaluating effect of transfer function zeros on transient response of aircraft and determining desirable regions of pole-zero locations
[NASA-TM-X-2585] N72-27024

DYNAMIC MODELS
Vortex model for describing steady and unsteady free boundary flows
N72-27287

DYNAMIC RESPONSE
Response of shroud-enclosed spacecraft to combined acoustic-vacuum environments
[NASA-TM-X-65922] N72-27734

DYNAMIC STABILITY
Dynamic stability of rods connected by spring when subjected to periodic longitudinal loading and comparison with theoretical considerations
[NAL-TR-257] N72-27953

E

E REGION
Ionospheric propagation data for E and F regions, India - Sept. 1970
[RTRC-A184] N72-27373
Ionospheric propagation data for E and F regions, India - Aug. 1970
[RTRC-A183] N72-27374

EARDRUMS
Human eardrum rupture and hearing loss injuries from nuclear explosions
[AD-737643] N72-27092

EARTH [PLANET]
Empirical data and variance-covariance matrix for 1969 Smithsonian Standard Earth [2]
[NASA-CR-127269] N72-27361

EARTH ATMOSPHERE
Atmospheric electricity and earth meteorology
[NLL-M-22318-[5828.4F]] N72-27336
Effects of solar constant change on earth climate
[NLL-M-22455-[5828.4F]] N72-27830
Activities of National Center for Atmospheric Research during 1971 with emphasis on cooperation with other research organizations and activities
[AR-10] N72-27979

EARTH HYDROSPHERE
Multispectral photographic technique proposed for Earth Resources Program to study lithosphere, hydrosphere, and biosphere
N72-27386

EARTH PLANETARY STRUCTURE
Earthquake observations from seismological stations of the south Kurile Island arc
[TT-70-50126] N72-27399

EARTH RESOURCES
Using remote sensors for controlled studies of reflectance and emittance characteristics of foliage on trees subjected to stresses
[NASA-CR-127420] N72-27375

EARTH RESOURCES PROGRAM
Multispectral photographic technique proposed for Earth Resources Program to study lithosphere, hydrosphere, and biosphere
N72-27386

EARTH RESOURCES SURVEY AIRCRAFT
Environmental impact statement for Earth Resources Aircraft program
[NASA-TM-X-68550] N72-27008

EARTH RESOURCES TECHNOLOGY SATELLITES
Environmental impact statement for Earth Resources Technology Satellites
[NASA-TM-X-68552] N72-27906

EARTHQUAKES
Rayleigh wave detection from Kurile Island earthquakes
[AD-739174] N72-27396
Earthquake observations from seismological stations of the south Kurile Island arc
[TT-70-50126] N72-27399

ECONOMICS
Economic analysis of transport aircraft operating in transonic region with consideration of materials, aerodynamic configuration, and cruise speed
[NASA-TM-X-62159] N72-27015
Biological and economic aspects and technological base of remotely manned systems
[P-4809] N72-27256

EDGES
Intersecting all edges of centrally symmetric polyhedra by hyperplanes
[AD-739711] N72-27628

EDUCATION
Training requirements for welding design
N72-27502
Transformation of scientists and engineers into managers
[NASA-SP-291] N72-27986

EFFICIENCY
Operational efficiency of countercurrent continuous gas chromatograph with enlarged processing column
[NLL-RTS-6992] N72-27407

EIGENVALUES
Numerical method for eigenvalue calculation in Laplace tidal equation for semidiurnal and diurnal oscillations
[NLL-M-22323-[5828.4F]] N72-27612

ELASTIC BENDING
Application of finite element method for analyzing bending stiffness of cylindrical shells and truncated conical shell
[NAL-TR-262] N72-27952

ELASTIC CYLINDERS
Application of hybrid finite element method for analyzing vibration properties of cylindrical shells
N72-27954

ELASTIC MEDIA
Application of impulsive step function technique for solving boundary value problem of elliptic cylindrical cavity in infinite solid
[TAE-148] N72-27951

ELASTIC PLATES
Numerical analyses of large amplitude vibrations of thin elastic plates and shallow shells under random excitation and limiting boundary conditions
[AD-739976] N72-27958

ELASTIC WAVES
Characteristic equations in generalized curvilinear tensor form for solving elastic wave propagation problems
[NASA-CR-127122] N72-27176

ELASTOHYDRODYNAMICS
Analysis of elastohydrodynamic properties of advanced engine lubricants with determination of traction coefficients and film thickness
[AD-739390] N72-27546

ELASTOMERS
Synthesis of alpha, omega bis [hydroxy dimethyl silyl phenyl] perfluoro alkane thermally stable elastomer
[RAE-TR-71224] N72-27159

ELECTRIC BATTERIES
Investigation of electrical fire on Vickers Viscount transport aircraft at Honolulu International Airport, Hawaii, 8 August, 1971
[PB-207902] N72-27049

ELECTRIC BRIDGES
All-pass networks with Wien bridge and differential amplifier
[NLL-TRANS-2850-[9022.81]] N72-27248

ELECTRIC CONDUCTORS
Controlled distribution of electrophoretic samples in flow path through conductive screens
[NASA-CASE-MFS-21395-1] N72-27425

ELECTRIC CONNECTORS
Electrical interconnection of unilluminated solar cells in solar battery array
[NASA-CASE-GSC-10344-1] N72-27053

ELECTRIC CORONA
Dimensions of anti-corona electrodes for high voltage test equipment
[NLL-CE-TRANS-5794-[9022.09]]
N72-27247

ELECTRIC CURRENT
Electrode with multiple columnar conductors for limiting field emission current
[NASA-CASE-ERC-10015-2] N72-27246
Electric coupling between magnetosphere and ionosphere noting time dependent fields, substorms, auroral arcs and double layers
[TRITA-EPP-72-11] N72-27385

ELECTRIC EQUIPMENT
Electric heaters for simulating nuclear fuel elements during heat transfer experiments
[NLL-CE-TRANS-5885-[9022.09]]
N72-27715

ELECTRIC FIELDS
Static electrification, bonding, grounding, and lightning protection techniques applied to aircraft, spacecraft, and missiles
[AD-739356] N72-27037
Computer aided analysis of electric and fluid fields in electrofluid dynamic generators
[AD-739547] N72-27070
Convective electric field and magnetospheric plasma observations using Explorer 40 satellite
[NASA-CR-127254] N72-27350
Correlations between azimuthal direction of interplanetary magnetic field and polar cap electric field distributions
[NASA-TM-X-65934] N72-27365
Electric coupling between magnetosphere and ionosphere noting time dependent fields, substorms, auroral arcs and double layers
[TRITA-EPP-72-11] N72-27385
Development and characteristics of apparatus for measuring intensity of electric field in atmosphere
[NASA-CASE-KSC-10730-1] N72-27431
Gas discharges in crossed nonuniform electric and transverse magnetic fields
[AD-739290] N72-27780

ELECTRIC FILTERS
Filter for third order phase locked loops used in signal receivers
[NASA-CASE-NPO-11941-1] N72-27249

ELECTRIC GENERATORS
Analysis of secondary power system for use with advanced rotary wing aircraft for reliable production of electric power
[AD-739480] N72-27069
Feedback controlled dc to dc converter with input/output isolation for voltage regulation
[NASA-CASE-HQN-10792-1] N72-27230

ELECTRIC MOTORS
Effects of back iron saturation on single sided induction motor performance
[PB-207327] N72-27238

ELECTRIC NETWORKS
Computerized graph techniques based on algorithms with several applications including molecular structures and networks
[REPT-127] N72-27221

ELECTRIC POWER SUPPLIES
Electrical power distribution system for providing many dc voltages
[NASA-CASE-MSC-12396-1] N72-27063
Test and evaluation of antifriction bearings for use in turbine-alternator-compressor units of Brayton cycle electric power supply
[NASA-TM-X-68095] N72-27529

ELECTRIC POWER TRANSMISSION
Electrical power distribution system for providing many dc voltages
[NASA-CASE-MSC-12396-1] N72-27063

ELECTRIC ROCKET ENGINES
Design and performance tests of 5-cm diameter ion thruster
[NASA-TM-X-68110] N72-27825

ELECTRICAL FAULTS
Nanosecond pulses for study of electric breakdown mechanism of ultrahigh vacuum
[AD-739280] N72-27743

ELECTRICAL INSULATION
Isolated dc amplifier for bioelectric measurements
[NASA-CASE-ARC-10596-1] N72-27233

ELECTRICAL MEASUREMENT
Potential step and triangular voltage sweep methods in surface capacitance measurements on porous silver electrodes
[AD-739482] N72-27242

ELECTRICAL PROPERTIES
Electrical characteristics of spiral groove delay system for centimeter wave band
[JPRS-56385] N72-27175
Property data tables for group 2-6 compounds
[AD-739359] N72-27799

ELECTRICAL RESISTIVITY
Increased resistivity of thin metallic films caused by gas adsorption
[NLL-TRANS-746-1194-[9022.401]]
N72-27789
Comparison of Lorentz number calculations in semiconductors
[AD-739245] N72-27802

ELECTRO-OPTICS
Design and development of light sensing device for controlling orientation of object relative to sun or other light source
[NASA-CASE-NPO-11201] N72-27409
Electro-optical stabilization of calibrated light source
[NASA-CASE-MSC-12293-1] N72-27411
Design and performance of electro-optical solar orientation and navigation instruments
N72-27433
Theoretical and experimental analysis of mode filters for single frequency Nd YAG lasers and wideband electro-optic modulators
[AD-738489] N72-27552
Characteristics of electro-optical terminal guidance systems, area correlators, and gated trackers used for guidance and control of tactical missiles
N72-27688
Bibliography on linear electro-optic modulator materials
[AD-739360] N72-27742

ELECTROACOUSTIC WAVES
Electroacoustic effects in III-V compound semiconductors
[RR-725] N72-27791

ELECTRODES
Compressible electrolyte saturated sponge electrode for biomedical applications
[NASA-CASE-MSC-13648] N72-27103
Potential step and triangular voltage sweep methods in surface capacitance measurements on porous silver electrodes
[AD-739482] N72-27242
Electrode with multiple columnar conductors for limiting field emission current
[NASA-CASE-ERC-10015-2] N72-27246
Dimensions of anti-corona electrodes for high voltage test equipment
[NLL-CE-TRANS-5794-[9022.09]]
N72-27247
Tungsten-rhenium electrode performance in cesium thermionic converters
[NASA-TM-X-68091] N72-27722
Material transfer from electrodes during high vacuum pulse breakdown, using copper cathode
[AD-739208] N72-27744

ELECTROHYDRODYNAMICS
Computer aided analysis of electric and fluid fields in electrofluid dynamic generators
[AD-739547] N72-27070

ELECTROLYSIS
Reduction reactions and electrolytic separation of manganese dioxide in acid solution
[NLL-M-22291-[5828.4F]] N72-27141
Production of ultrafine beryllium particles by electrolysis
[NASA-CR-127427] N72-27577

ELECTROLYTES
Automated, six channel, discrete sample electrolyte analyzer, using peristaltic pump
[AD-737568] N72-27091
Compressible electrolyte saturated sponge electrode for biomedical applications
[NASA-CASE-MSC-13648] N72-27103

ELECTROLYTIC CELLS
Lithium organic electrolyte single cells with fluorographite cathodes
[AD-739488] N72-27071

ELECTROMAGNETIC FIELDS
Transition amplitudes of multiphoton excitations of vibrational rotational states in diatomic molecules in intense electromagnetic fields
[NASA-CR-127419] N72-27761

ELECTROMAGNETIC INTERACTIONS
Field model for weak and electromagnetic interactions of leptons and hadrons with charge parity violations
[TR-72-084] N72-27768

ELECTROMAGNETIC INTERFERENCE
Detailed program description portion of user manual for computer programs relating to electromagnetic interference prediction and analysis process - Part 1
[AD-739526] N72-27196
Detailed program description portion of user manual for computer programs relating to electromagnetic interference prediction and analysis process - Part 2
[AD-739527] N72-27197
Logic flow diagrams and glossary of computer symbols portion of user manual for computer programs relating to electromagnetic interference prediction and analysis process - Part 1
[AD-739528] N72-27198
Logic flow diagrams and glossary of computer symbols portion of user manual for computer programs relating to electromagnetic interference prediction and analysis process - Part 2
[AD-739529] N72-27199
Logic flow diagrams and glossary of computer symbols portion of user manual for computer programs relating to electromagnetic interference prediction and analysis process - Part 3
[AD-739530] N72-27200

ELECTROMAGNETIC PROPERTIES
Methods for determining electromagnetic characteristics of severe thunderstorms-Themis weather project
[AD-739544] N72-27668

ELECTROMAGNETIC RADIATION
Construction and operation of superhigh frequency transmitter and receiver installation for color television system
[REPT-150] N72-27269

ELECTRON ACCELERATORS
Measurement of beam currents in millions of amperes using megampere accelerator
[AD-739294] N72-27281

ELECTRON BEAM WELDING
Benefits of using high voltage electron beam welding on product design and production applications
N72-27503
Design requirements for components to be electron beam welded
N72-27504
Thermodynamics of electron beam metal welding with dagger fusion
[AD-739289] N72-27533
Precision electron beam welding and equipment for industrial production applications
[AD-739282] N72-27536

ELECTRON BEAMS
Measurement of beam currents in millions of amperes using megampere accelerator
[AD-739294] N72-27281
Microchannel electron multiplier array for double proximity focusing image tube design
N72-27442

ELECTRON DENSITY (CONCENTRATION)
Electron and neutral particle concentration and temperature for computing heat influx to electron gas
N72-27378
Electron temperature and density in shock-produced argon plasma
[CP-33] N72-27773
Electron densities in ionization relaxation zone behind shock waves in argon
[CP-32] N72-27774
Precursor electron and ion densities ahead of ionizing shock waves
[CP-31] N72-27775

ELECTRON EMISSION
Plasma generation in free air, explosive electron emission, and superstrong pulsed magnetic fields
[AD-739324] N72-27779
Free-free emission and magnetospheric electron density of Jupiter
N72-27862

ELECTRON ENERGY
Electron energy along stagnation point streamline ahead of blunt body in nonequilibrium, partially ionized gas at supersonic speed
[CP-35] N72-27319
Time resolution measurements of energetic electrons in auroral breakup, and electron multiplier
[NASA-CR-127522] N72-27346
Electron and neutral particle concentration and temperature for computing heat influx to electron gas
N72-27378
Electron temperature and density in shock-produced argon plasma
[CP-33] N72-27773
Diffusion model for energy dependence of electron anisotropy in cosmic rays
[RM-548] N72-27838
Equatorial electron energy, number density, and radiative half life in Jupiter magnetosphere, based on synchrotron model with Maxwellian energy distribution
N72-27853
Electron and proton energies, densities, and fluxes from 1 to 6 Jupiter radii
N72-27863

ELECTRON GAS
Electron and neutral particle concentration and temperature for computing heat influx to electron gas
N72-27378

ELECTRON GUNS
Small electron gun with four electrodes for Auger and ultrasoft X ray instruments
[PB-207208] N72-27240

ELECTRON MICROSCOPES
Computer technique for data reduction and correction in quantitative electron probe microanalysis
[NBS-TN-719] N72-27209

ELECTRON PHONON INTERACTIONS
Collisional broadening of Landau levels in polar semiconductor noting high order perturbation effects
N72-27795

ELECTRON PLASMA
Frequency and growth rate of ion acoustic instability associated with relative streaming of electrons and ions across weak magnetic fields
[NASA-CR-127272] N72-27771

ELECTRON PRECIPITATION
Electron precipitation in inner radiation belt in geomagnetic field deformation
[ESRO-SN-117] N72-27382

ELECTRON TRANSITIONS
Transition amplitudes of multiphoton excitations of vibrational rotational states in diatomic molecules in intense electromagnetic fields
[NASA-CR-127419] N72-27761
Atomic hydrogen hyperfine transition in free atom beam standard
[NASA-TM-X-65932] N72-27763

ELECTRON TUBES
Construction of mass spectrometer tubes for gas analysis
[NASA-CR-122433] N72-27231
Repair times and maintenance life cycle cost comparison between transistors and tubes
[AD-739476] N72-27239

ELECTRONIC CONTROL
Design of electronically controlled tracking radar system with phased arrays
[REPT-162] N72-27183
Electronically controlled radar tracking with Kalman filtering
[REPT-173] N72-27184

ELECTRONIC EQUIPMENT
Electrical power distribution system for providing many dc voltages
[NASA-CASE-MSC-12396-1] N72-27063
Comparing visual and auditory displays when used as dynamic tri-level condition displays for electronic checkout
[AD-739475] N72-27477

ELECTRONIC FILTERS
Analysis of rebalance loop in strapdown inertial platform to show pulse shape, dc bias, and sampling process
N72-27675

ELECTRONS
Electron spectra in inner radiation belt observed by Cosmos 219 satellite
[NASA-TT-F-14405] N72-27355
Relation between creep rupture strength and electron microstructure of Cr-Mo steels after heat treatment
[NLL-CE-TRANS-5594-[9022.09]]
N72-27560
Electron conduction in glass and preparation of conducting glasses
[NLL-TRANS-852-[9022.64]] N72-27598
Lithium-drifted silicon detectors, fission cell, electron flux detectors, and semiconductor devices
[NASA-CR-127267] N72-27847
Calculated electron and proton dose rates in Jupiter radiation belts
N72-27852
Estimates of energetic electron and proton fluxes in Jupiter radiation belts, dose rates for shielding, and radiation lifetimes of electronic circuits
N72-27854
Specific and monograph models of energetic electrons and protons in Jupiter magnetosphere
N72-27855
Uncertainties in electron and proton flux models and resulting uncertainties in fluences for Jupiter flyby missions
N72-27857
Upper limits of electron and proton fluxes in Jupiter radiation belts, using radial diffusion for getting solar wind fluxes into inner regions of belts
N72-27868
Geiger-Mueller tube epxeriment package for Pioneers F and G to study energetic electrons and protons in Jupiter magnetosphere
N72-27871
Quiet time component of interplanetary electrons in energy range 18 keV to 1.8 MeV
[NASA-TM-X-65935] N72-27889

ELECTROPHORESIS
Zero gravity, constant flow electrophoretic separating apparatus
[NASA-CASE-MFS-21394-1] N72-27310
Controlled distribution of electrophoretic samples in flow path through conductive screens
[NASA-CASE-MFS-21395-1] N72-27425

ELECTROPHOTOMETRY
Precision measurements using colorimetry techniques to include spectrophotometry, reflectometry, metamerism, and tristimulus values - Vol. 9
[NBS-SP-300-VOL-9] N72-27524

ELECTROPHYSIOLOGY
Interactive graphics for structural languages and biological waveform analysis, using special purpose computers
[AD-739258] N72-27135

ELECTROPOLISHING
Cathode with insulating material for electrolytic brush polishing of metal surfaces
[NLL-T-1514-[9022.305]] N72-27488

ELECTROSLAG REFINING
Graphite particle cementation in electrically conductive fluidized bed
[NLL-TRANS-746-1149-[9022.401]]
N72-27490

ELECTROSTATIC PROBES
Langmuir probe surface contamination noting plasma jet simulation, decontamination methods, and material selection
[ESRO-SN-115-ESTEC] N72-27531

ELEMENTARY PARTICLE INTERACTIONS
Interactions of nucleons bound in heavy nuclei with high energy cosmic rays
[NASA-TT-F-14409] N72-27832

ELONGATION
Uniform elongation and work hardening of sheet and spherical aluminum and copper alloys, brass, and steel
[NLL-TRANS-746-1121-[9022.401]]
N72-27557

EMBRITTLEMENT
Hydrogen embrittlement and carbide disintegration of metals used in pressure vessels
N72-27494
Analysis of metal embrittlement in hydrogen environments
[NASA-TM-X-68088] N72-27574

EMERGENCY LIFE SUSTAINING SYSTEMS
Effectiveness and limitations of current portable oxygen breathing equipment for mine rescue operations
N72-27107
Design of portable decompression chamber with semiclosed gas recirculation system for treating underwater divers
N72-27116
Life support system for rescue crew in altitude chamber tests
N72-27133

EMITTANCE
Using remote sensors for controlled studies of reflectance and emittance characteristics of foliage on trees subjected to stresses
[NASA-CR-127420] N72-27375

ENCAPSULATING
High temperature and humidity effects on plastic encapsulated semiconductors
[AD-739473] N72-27806

ENDOCRINE SECRETIONS
Existence of hypocalcemic factor in human thyroids
[NASA-TT-F-14341] N72-27079

ENERGY
Optimization technique for determining exact energy and wave functions in exchange perturbation processes
[NASA-CR-127265] N72-27154

ENERGY CONVERSION
Physical processes underlying solar-energy conversion through photovoltaic effect
N72-27057
Japanese research and development progress in energy conversion and chemical propulsion
[AD-739325] N72-27067

ENERGY CONVERSION EFFICIENCY
Technical feasibility of improving efficiency of solar cells for space programs
[NASA-CR-127234] N72-27055
Considerations, conclusions, and recommendations for improving efficiency of solar cells
N72-27056
Maximum efficiency of solar energy conversion for photovoltaic cells
N72-27058
Analysis of loss mechanisms in silicon solar cells and their impact on conversion efficiency
N72-27059

ENERGY DISSIPATION
Analysis of loss mechanisms in silicon solar cells and their impact on conversion efficiency
N72-27059

ENERGY DISTRIBUTION
Optimal means of characterizing product and reactant energy distributions in molecular collisions, information content of internal state distribution, and entropy deficiency
[NASA-CR-127261] N72-27757

ENERGY OF FORMATION
Calorimeter standard for determining energy of ion pair formation in air
[NLL-M-22434-[5828.4F]] N72-27417
ENERGY SOURCES
Heat balance equations for studying diurnal heat budget of thermosphere
[NASA-TM-X-65928] N72-27364
ENGINE DESIGN
Interference problems of airframe engine integration in aircraft design optimization
[AGARD-LS-53] N72-27016
Determination of thrust and drag characteristics for integrated aircraft engine design optimization N72-27023
Design and fabrication of low cost turbojet and turbofan engines
[NASA-TM-X-68085] N72-27816
Design and development of movable turbine inlet guide vanes to provide aerodynamic choking for jet engine
[NASA-CASE-LAR-10642-1] N72-27820
ENGINE FAILURE
Afterburning steady state performance and operational limits of TF-30 turbofan engine
[NASA-TN-D-6839] N72-27014
ENGINE INLETS
Application of streamline curvature method for determining performance of turbofans and comparison with empirical results
[NAL-TR-268T] N72-26999
Development and evaluation of fluidic turbine inlet gas temperature sensors
[NAL-TR-265] N72-27428
Design and development of movable turbine inlet guide vanes to provide aerodynamic choking for jet engine
[NASA-CASE-LAR-10642-1] N72-27820
ENGINE NOISE
Analysis of noise generated by target type thrust reversers used on augmentor-wing short takeoff aircraft
[NASA-TM-X-68082] N72-27012
ENTROPY
Optimal means of characterizing product and reactant energy distributions in molecular collisions, information content of internal state distribution, and entropy deficiency
[NASA-CR-127261] N72-27757
ENVIRONMENT SIMULATION
Bibliography of simulation models for vegetation
[NASA-CR-127426] N72-27082
Attitude simulator for performance prediction of infrared horizon scanner for onboard geostationary satellite, noting rotating and static simulation N72-27462
ENVIRONMENT SIMULATORS
Simulation and design of breathing metabolic simulator N72-27129
Ethylene chemiluminescence ozone detector for smog chamber studies
[BM-RI-7650] N72-27420
ENVIRONMENTAL SURVEYS
Environmental impact statement for Earth Resources Aircraft program
[NASA-TM-X-68550] N72-27008
Environmental impact survey of Goddard Space Flight Center, Greenbelt, Maryland
[NASA-TM-X-68549] N72-27263
Environmental impact statement for Marshall Space Flight Center Huntsville, Ala, and MTF in Hancock County Mississippi
[NASA-TM-X-68542] N72-27264
Environmental impact statement for Wallops Station Virginia
[NASA-TM-X-68547] N72-27265
Environmental impact statement for Lewis Research Center Cleveland, Ohio
[NASA-TM-X-68557] N72-27266
Environmental impact statement for Jet Propulsion Laboratory at Pasadena, California
[NASA-CR-127575] N72-27267
Environmental impact statement for Nuclear Rocket Development Station, Nevada
[NASA-TM-X-68555] N72-27268
Environmental impact survey of airport on Park Falls, Wisconsin
[PB-204025-F] N72-27284
Impact of GARP on environment
[NASA-TM-X-68546] N72-27632
Environmental impact survey of hail in Colorado, Wyoming, and Nebraska
[PB-207539-F] N72-27661
Environmental impact surveys of quiet engine program
[NASA-TM-X-68545] N72-27814
Environmental impact statement of Apollo project based on ten Apollo spacecraft and Saturn 5 launch vehicle operations at Cape Kennedy Launch Complex, Florida
[NASA-TM-X-68544] N72-27903
Environmental impact survey of Pioneer F/G program
[NASA-TM-X-68543] N72-27904
Environmental impact statement for Skylab program
[NASA-TM-X-68553] N72-27905
Environmental impact statement for Earth Resources Technology Satellites
[NASA-TM-X-68552] N72-27906
Environmental impact statement for TIROS program
[NASA-TM-X-68551] N72-27907
Environmental impact statement of Nimbus satellite program
[NASA-TM-X-68554] N72-27908
Environmental impact statement for physics and astronomy sounding rocket, balloon, and airborne research programs
[NASA-TM-X-68556] N72-27909
Environmental impact statement of space shuttle program
[NASA-TM-X-68541] N72-27910
ENVIRONMENTAL TESTS
Meteorological radar surveillance of atmospheric conditions during artillery tests conducted in Panama
[AD-739485] N72-27666
ENVIRONMENTS
Statistics and environmental causes of amplitude modulation near ocean surface
[AD-739357] N72-27388
ENZYMES
Active transport of Na and K ions and reaction mechanism for ATP-ase
[NLL-RTS-6898] N72-27075
EPHEMERIDES
Real world geopotential model with low orbit trajectories
[AD-739492] N72-27940
EPINEPHRINE
Effects of bromotrifluoromethane inhalation and epinephrine challenge on cardiovascular system
[AD-739699] N72-27098
EPOXY RESINS
Corrosion inhibiting properties of epoxy primers used in aluminum alloys
[AD-738446] N72-27606
EQUATIONS OF MOTION
Numerical analysis of response of spherical balloon to atmospheric turbulence and three-dimensional time-dependent flows
[NASA-TN-D-6829] N72-27001
Evaluation of dynamic stability of projectiles based on pitch damping moment transverse radius of gyration, and Magnus moment
[AD-738016] N72-27005
EQUATIONS OF STATE
Establishment of Joule-Thomson inversion curves for various gases using equations of state
[NASA-TN-D-6807] N72-27965
EQUILIBRIUM
Tests of broadband high intensity noise on human equilibrium
[AD-737826] N72-27093
EQUIPMENT SPECIFICATIONS
Development of criteria for application of composite materials in construction of helicopter synchronizing drive shafts
[AD-739429] N72-27043
Modified Apollo portable life support system for Skylab astronauts N72-27117
Electrical/mechanical properties, operation, theory of operation, parts list, and electrical diagrams for model 5208A bit synchronizer unit
[NASA-CR-115645] N72-27218
Development of test apparatus for subjecting metal specimen to tensile and compressive loads at constant temperature
[NASA-CASE-LAR-10426-1] N72-27947
ERBIUM COMPOUNDS
Measured output of germanium photovoltaic cell with erbium oxide and silicon carbide radiators
[AD-739489] N72-27072
EROSION
Reduction of accelerator grid erosion due to direct impingement of ion beam
[NASA-TM-X-68096] N72-27824
ERROR ANALYSIS
Statistical covariance technique for computerized error analysis on missile tracking system
[AD-739513] N72-27223
Error analysis and accuracy of gyroscopic instruments used in inertial navigation
[JPRS-56387] N72-27695
Error analysis for inertial navigation system using azimuth gyrocompass and directional gyroscope N72-27696
Error source in micro-weighting of radioactivity drop
[NLL-M-22443-[5828.4F]] N72-27749
ERROR CORRECTING DEVICES
Operating procedure and controls and indicators for data compression/error correction digital test system
[NASA-CR-115643] N72-27219
ESRO SATELLITES
Metallurgical test facilities for ESRO satellites noting techniques and equipment
[ESRO-TM-153-ESTEC] N72-27276
ESTIMATES
Best estimates of multivariate functions based on derivatives
[NLL-M-22320-[5828.4F]] N72-27613
ESTIMATING
Smooth empirical Bayes estimator for random scale components of observation error variances for discrete time linear system
[NASA-CR-127527] N72-27620
ETHERS
Formation of polyurethane resins from hydroxy terminated perfluoro ethers
[NASA-CASE-NPO-10768-2] N72-27144
EULER EQUATIONS OF MOTION
Numerical analysis of three dimensional ideal gas flow and Euler equations of motion N72-27307
Development of frequency model for single degree of freedom rate integrating gyroscope using Eulerian formulation
[AD-739182] N72-27711
EUROPE
Development of remote sensing techniques in Europe
[SI-5] N72-27381
Synoptic analysis of weather conditions over Atlantic Ocean and Europe for period 14 to 17 February 1962 as basis for determining atmospheric energetics
[REPT-127] N72-27636
Research in Hungary, Poland, Romania, and Yugoslavia in fields of physics, space science, and medicine
[JPRS-56289] N72-27733
Scientific and technical information systems and organizations in East Europe
[JPRS-56460] N72-27895
EUROPEAN SPACE PROGRAMS
Research in Hungary, Poland, Romania, and Yugoslavia in fields of physics, space science, and medicine
[JPRS-56289] N72-27733
EUTECTIC ALLOYS
Analysis of conditions producing superplasticity in nickel-chromium eutectic alloy
[NLL-TRANS-746-1185-[9022.401]] N72-27568
EVALUATION
Methods for performing evaluation and processing data following flight tests of air traffic control beacon
[AD-738680] N72-27709
EVAPORATION
Ice crystal terminal velocities for calculating ice crystal growth in clouds, evaporation in subcloud regions, and precipitation rates
[NASA-CR-127428] N72-27645
EXOBIOLOGY
Results of studies on microorganisms with direct bearing on space biology
[NASA-TT-F-14307] N72-27081
EXOSPHERE
Photoelectron effects in polar ion-exosphere and kinetic wind model
[A-N99-1972] N72-27371
Semiannual atmospheric density variations in exosphere June 1968 through December 1970
[RAE-TR-71150] N72-27897
EXPLORER SATELLITES
Baseline communications channel model for studying low bit rate telemetry transmissions from Explorer satellites
[NASA-CR-122435] N72-27168
Explorer 45 plasmapause measurements
[NASA-TM-X-65931] N72-27432
EXPLORER 34 SATELLITE
Computer programming for analysis of Explorer 34 magnetic field data
[NASA-TM-X-63086] N72-27894
EXPLORER 40 SATELLITE
Convective electric field and magnetospheric plasma observations using Explorer 40 satellite
[NASA-CR-127254] N72-27350
EXPLOSIONS
Detonation characteristics of heterogeneous systems consisting of petroleum and oxygen contained in pipes
[NLL-298-[8660.5]] N72-27961
EXPLOSIVE DEVICES
Development of apparatus for detonating explosive devices in order to determine forces generated and detonation propagation rate
[NASA-CASE-LAR-10800-1] N72-27959
EXTRACTION
Research in economic geology and extractive metallurgy
[REPT-9] N72-27367
EXTRAVEHICULAR ACTIVITY
Portable life support system for astronaut working outside of lunar module N72-27109
Regenerative portable life support system development for extravehicular human activities during advanced space missions N72-27113

Carbon dioxide- and thermal-control in regenerative life support system for extravehicular human protection during advanced space missions
N72-27114

EXTRUDING
Force parameters in rotary extrusion of thin walled shells of revolution
[NLL-M-21379-[5828.4F]] N72-27489
Empirical equation describing flow stress and strain rates of metals at high temperatures during extrusion
[NLL-LTI-746-1181-[9022.401]] N72-27571

EYE EXAMINATIONS
Opthalmologic examinations for determining retina damage caused by helium-neon laser boresights
[AD-738629] N72-27087

F

F REGION
Ionospheric propagation data for E and F regions, India - Sept. 1970
[RTRC-A184] N72-27373
Ionospheric propagation data for E and F regions, India - Aug. 1970
[RTRC-A183] N72-27374

F-4 AIRCRAFT
Simulation of dynamic spin of F-4 aircraft under pilot control using human centrifuge facility
[AD-739326] N72-27278

F-5 AIRCRAFT
Analysis of military requirements and specifications for aircraft performance using F-5 aircraft
[AD-738625] N72-27039

F-28 TRANSPORT AIRCRAFT
Fatigue crack propagation in Fokker F-28 full-scale wing structure under cyclic gust flight simulation loading
[NLR-TR-71043-U] N72-27955

FABRY-PEROT INTERFEROMETERS
Application of Fabry-Perot interferometers and duochromators to plasma diagnostics
[AD-738633] N72-27782

FAILURE ANALYSIS
Analyzing failure of welded structures to determine design criteria for preventing brittle fracture initiation
N72-27495
Criteria for optimum design of welded structures to withstand dynamic service stresses
N72-27510
Analysis of structural failures occurring during NASA programs and recommendations to prevent or minimize similar failures in future programs
[NASA-TM-X-68850] N72-27946

FAILURE MODES
Relevance of quality control tests by material producer to welded design
N72-27497
Thermal deformation effects on bond integrity and causing of failure modes
N72-27521

FALLOUT
Global fallout measurements of Pu-238 from SNAP-9A burnup
[HASL-250] N72-27724

FAR FIELDS
On-axis, far field, difference frequency pressure generated in high amplitude, primary sound field
[AD-739321] N72-27740

FAR INFRARED RADIATION
High resolution three part bolometer for far infrared detection
N72-27438

FAR ULTRAVIOLET RADIATION
High resolution photomultiplier tube for onboard far ultraviolet photometer in aerospace environment
N72-27441
Onboard supervidicon-fiber optical assembly of image converter/integrator vidicon for UV stellar radiation
N72-27445
Specifications for onboard ultraviolet thin metallic film mirrors, filters, and interferometers for aerospace environments
N72-27446
Specifications of multichannel solar spectrometer onboard OSO-1, noting experimental design
N72-27457
Technology and performance characteristics of directive diffuser for ultraviolet use
N72-27465

FARADAY EFFECT
Ionospheric electron content vs local time data from Faraday rotation observations at Urbana, Illinois from 1 Dec. 1967 to 30 Dec. 1970
[NASA-CR-127524] N72-27369
Jupiter decimetric data on brightness contour maps, emission centroid position, circular polarization and magnetic field strength, and Faraday rotation and thermal electron density
N72-27861

FARM CROPS
Forest density determined from aerial photographs, protection of farm crops against hail, and other scientific and technical research in Eastern Europe
[JPRS-56426] N72-27981

FAST NUCLEAR REACTORS
High integrity tube-to-tubeplate bore welds for sodium cooled fast reactor
N72-27505

FATIGUE [MATERIALS]
Fatigue strength and crack propagation in welded joints
[AD-739341] N72-27540
Mechanism of fatigue enhancement in selected high strength aluminum alloys related to unique microstructures
[AD-738450] N72-27584
Role of carbide morphology on low cycle fatigue behavior of iron-carbon alloys
[AD-739508] N72-27592

FATIGUE LIFE
Design method for estimating fatigue life of seam-welded pipelines subjected to fluctuating pressures
N72-27499
Derivation of equation to predict rolling-element fatigue lives of through-hardened bearing steels combining effects of material hardness, carbide factor, and bearing temperature
[NASA-TM-X-68078] N72-27573

FEDERAL BUDGETS
Congressional appropriation in response to fiscal year 1973 budget requests submitted by HUD, NASA, NSF, and VA
[S-REPT-92-820] N72-27973
Congressional appropriations hearings for fiscal year 1973 funds required by HUD, NASA, NSF, and VA
[H-REPT-92-1071] N72-27974
Congressional hearings to determine fiscal year 1973 funding of HUD, NASA, NSF, VA, and several independent committees
N72-27977
Statistical analysis of Federal obligations awarded to universities and colleges for academic science activities for fiscal year 1970
[NSF-72-301] N72-27978

FEED SYSTEMS
Pressurized tank for feeding liquid waste into processing equipment
[NASA-CASE-LAR-10365-1] N72-27102
Pressurized inert gas feed for lighting system
[NASA-CASE-KSC-10644] N72-27227

FEEDBACK
Iterative method for synthesis of linear time-varying feedback system with parameter ignorance
[NASA-CR-116777] N72-27252

FEEDBACK CONTROL
Feedback controlled dc to dc converter with input/output isolation for voltage regulation
[NASA-CASE-HQN-10792-1] N72-27230
Synthesis of feedback systems with large plant ignorance for prescribed time domain tolerances
[NASA-CR-116779] N72-27253

FERRITES
Effect of gamma irradiation on first constant of magnetic crystallographic anisotropy of single crystals of nickel and nickel copper ferrites
[AD-739286] N72-27805

FERROMAGNETIC MATERIALS
Influence of relaxation processes on Mossbauer measurements of superparamagnetic alpha-FeOOH and alpha-Fe2O3 crystallites
N72-27793

FERRY SPACECRAFT
Design, development, and characteristics of modular space station for use with space shuttle system
[NASA-CR-123719] N72-27912

FEYNMAN DIAGRAMS
Expressions for contributions by first and second order Feynman diagrams in terms of radial integrals for light atoms
[NASA-TT-F-14403] N72-27752
Numerical calculations of contributions by first and second order Feynman diagrams for light atoms
[NASA-TT-F-14402] N72-27753

FIBERS
Applications, production, and physical properties of high temperature fiber composites
[NLL-TRANS-746-1195-[9022.401]] N72-27599

FIELD EMISSION
Electrode with multiple columnar conductors for limiting field emission current
[NASA-CASE-ERC-10015-2] N72-27246

FIELD THEORY [PHYSICS]
Bounded coupling constants in field theory with one space and one time dimension
[TR-73-003] N72-27764
Monopole theory formulation with gauge dependent fields and potentials
[TR-72-129] N72-27767
Field model for weak and electromagnetic interactions of leptons and hadrons with charge parity violations
[TR-72-084] N72-27768
Solution of nonlinear Lee nuclear field theoretical model in Hilbert space
[NOTA-INTERNA-356] N72-27769

FIGHTER AIRCRAFT
Group cohesion, interceptors, all-weather operations, and flight safety
[AD-739229] N72-27988

FILAMENT WINDING
Inspection techniques for coated refractory metals and filamentary composites
N72-27518

FILAMENTS
Nitrogen atom generation by nitrogen gas flow over heated filaments
[AD-739520] N72-27164

FILM THICKNESS
Measurement of thickness of metallic coating on plastic sheet using two capacitive probes connected in bridge circuit
[NLL-293-[8660.5]] N72-27512
Analysis of elastohydrodynamic properties of advanced engine lubricants with determination of traction coefficients and film thickness
[AD-739390] N72-27546

FINANCIAL MANAGEMENT
Congressional hearings to determine fiscal year 1973 funding of HUD, NASA, NSF, VA, and several independent committees
N72-27977

FINITE ELEMENT METHOD
Finite element methods for fluid flow problems
N72-27305
Application of finite element method for analyzing bending stiffness of cylindrical shells and truncated conical shell
[NAL-TR-262] N72-27952
Application of hybrid finite element method for analyzing vibration properties of cylindrical shells
N72-27954

FINNED BODIES
Least squares method for analyzing finned missile rolling at large angle of attack
[AD-739685] N72-27245

FIRES
Investigation of electrical fire on Vickers Viscount transport aircraft at Honolulu International Airport, Hawaii, 8 August, 1971
[PB-207902] N72-27049

FISSION ELECTRIC CELLS
Lithium-drifted silicon detectors, fission cell, electron flux detectors, and semiconductor devices
[NASA-CR-127267] N72-27847

FLAME TEMPERATURE
Different combustion diagrams of jets for study on turbulent pulsations in temperature
[AD-739292] N72-27970

FLAMES
Analysis of confined laminar flames with emphasis on parameters which determine flame geometry and emission of soot
[NLL-T-1530-[9022.305]] N72-27960

FLAMMABILITY
Discussion of aircraft fuels and lubricants to include production, analysis, testing and fire safety
[AGARD-AR-44] N72-27811

FLASH LAMPS
Intensity control of condenser discharge light [flashers] for runway alignment indicator system
[FAA-RD-72-54] N72-27700

FLAT PLATES
Finite difference solutions to Navier-Stokes equations for laminar supersonic flow over flat plate and compression corner
[NASA-TR-R-385] N72-27311
Wind tunnel tests to determine effect of three dimensional sonic jets to promote boundary layer transition on sharp leading edge flat plate at hypersonic speed
[NASA-TN-D-6802] N72-27312

FLEXIBLE WINGS
Application of unconventional wing pivoting about spanwise axis forward of aerodynamic center for gust alleviation in general aviation aircraft
[NASA-CR-2046] N72-26996

FLIGHT CONTROL
Design of flight control system for launch vehicle models of geostationary satellite
[NAL-TR-264] N72-27932

FLIGHT PATHS
Optimization techniques for estimating height-velocity diagram and critical decision point for rotorcraft based on impulsive response functions
[NAL-TR-245] N72-27026

FLIGHT SAFETY
Development and characteristics of electronic signalling system and data processing equipment for warning system to avoid midair collisions between aircraft
[NASA-CASE-LAR-10717-1] N72-27703
Group cohesion, interceptors, all-weather operations, and flight safety
[AD-739229] N72-27988

FLIGHT SIMULATION
Simulation and training for spacecraft docking
N72-27882

Fatigue crack propagation in Fokker F-28 full-scale wing structure under cyclic gust flight simulation loading
[NLR-TR-71043-U] N72-27955
FLIGHT SIMULATORS
Device for applying simulated g-forces to arm of aircraft simulator pilot
[NASA-CASE-LAR-10550-1] N72-27271
Design, development, and fabrication of total in-flight simulator facility
[AD-739230] N72-27279
FLIGHT TESTS
Analysis of flight loads imposed on H-2 helicopter during fleet operations
[AD-738452] N72-27038
Design, development, and fabrication of total in-flight simulator facility
[AD-739230] N72-27279
Weather predictions for Concorde test flights and problems of forecasting stratospheric temperature and clear air turbulence
[NLL-M-22439-[5828.4F]] N72-27638
Methods for performing evaluation and processing data following flight tests of air traffic control beacon
[AD-738680] N72-27709
Flight test program to determine aerodynamic characteristics and performance of space shuttle vehicles in horizontal takeoff flight
[NASA-TM-X-68515] N72-27915
FLIGHT TIME
Statistical analysis of flight time, takeoff and landing weight, fuel weight at takeoff and landing for transport jet aircraft
[TB-88] N72-27035
FLORIDA
Environmental impact statement of Apollo project based on ten Apollo spacecraft and Saturn 5 launch vehicle operations at Cape Kennedy Launch Complex, Florida
[NASA-TM-X-68544] N72-27903
FLOTATION
Flotation processes for fine and coarse mineral particles
[NLL-RTS-6963] N72-27558
FLOW
Interaction between sonic two dimensional secondary injection jet and supersonic stream with axial pressure gradient
N72-27288
FLOW CHARACTERISTICS
Flow characteristics of turbine airfoil cooling system components
[NASA-CR-120883] N72-27290
FLOW CHARTS
Logic flow diagrams and glossary of computer symbols portion of user manual for computer programs relating to electromagnetic interference prediction and analysis process - Part 1
[AD-739528] N72-27198
Logic flow diagrams and glossary of computer symbols portion of user manual for computer programs relating to electromagnetic interference prediction and analysis process - Part 2
[AD-739529] N72-27199
Logic flow diagrams and glossary of computer symbols portion of user manual for computer programs relating to electromagnetic interference prediction and analysis process - Part 3
[AD-739530] N72-27200
FLOW DISTRIBUTION
Application of streamline curvature method for determining performance of turbofans and comparison with empirical results
[NAL-TR-268T] N72-26999
Integration of forebody and forebody/wing flow fields into airplane design criteria
N72-27018
FLOW EQUATIONS
Compilation of technical reports on theoretical aerodynamics and air flow - Vol. 1
[SBN-11-470151-2] N72-26993
Empirical equation describing flow stress and strain rates of metals at high temperatures during extrusion
[NLL-LTI-746-1181-[9022.401]]
N72-27571
FLOW MEASUREMENT
Measuring values characterizing structure of turbulent flow by hot-wire anemometers
[NLL-TRANS-T-1521-[9022.305]]
N72-27413
Hot-wire anemometer measurement of jet fluctuations in mass flow in gun tunnel
[TT-7205-REV] N72-27419
FLOW THEORY
Compilation of technical reports on theoretical aerodynamics and air flow - Vol. 1
[SBN-11-470151-2] N72-26993
FLOW VELOCITY
Formation and breakdown of water film moving over solid surfaces
[NASA-TM-X-68071] N72-27291
Two dimensional solutions for three dimensional velocity calculation on turbomachine centrifugal impeller flow
[NASA-TM-X-67959] N72-27720
FLOW VISUALIZATION
Analysis of helicopter rotor wake patterns using water tunnel test facility
[AD-739946] N72-27052
FLOWMETERS
Flowmeter and leak detector for gaseous flow detection in space environments
N72-27519
FLUENCE
Design fluences for electrons and protons and damage effects from low energy electrons and protons for spacecraft in Jupiter radiation belts
N72-27856
Uncertainties in electron and proton flux models and resulting uncertainties in fluences for Jupiter flyby missions
N72-27857
FLUID AMPLIFIERS
Fluid amplifier circuit for control of fluidic input signal
[NASA-CASE-LAR-10868-1] N72-27232
Performance tests on gyroscope and its fluid amplifier
[LRBA-E204-PV-5] N72-27471
FLUID DYNAMICS
Numerical analysis of one, two, and three dimensional fluid flow - conferences
[AGARD-LS-48] N72-27293
FLUID FILMS
Formation and breakdown of water film moving over solid surfaces
[NASA-TM-X-68071] N72-27291
FLUID FLOW
Numerical analysis of Navier-Stokes equations for time-dependent, nonlinear fluid flow
N72-27299
Finite element methods for fluid flow problems
N72-27305
FLUID MECHANICS
Mathematical aspects of fluid mechanics and numerical analysis of partial differential equations
N72-27294
MATHEMATICAL MODEL FOR FLUID MECHANICS
N72-27308
FLUIDIC CIRCUITS
Fluid amplifier circuit for control of fluidic input signal
[NASA-CASE-LAR-10868-1] N72-27232
FLUIDICS
Design, development, and evaluation of three-axis hydrofluidic stability augmentation system for UH-1 helicopter
[AD-739559] N72-27045
Fluid amplifier circuit for control of fluidic input signal
[NASA-CASE-LAR-10868-1] N72-27232
Development and evaluation of fluidic turbine inlet gas temperature sensors
[NAL-TR-265] N72-27428
Analysis of equipment necessary to set up digital fluidics systems laboratory
[AD-739430] N72-27476
FLUIDIZED BED PROCESSORS
Graphite particle cementation in electrically conductive fluidized bed
[NLL-TRANS-746-1149-[9022.401]]
N72-27490
FLUORESCENCE
Fluorescence spectra and optical filters
[NASA-CR-127257] N72-27149
FLUORINATION
Fluorinated polyurethanes produced by reacting hydroxy terminated perfluoro polyether with diisocyanate
[NASA-CASE-NPO-10767-2] N72-27151
FLUOROCARBONS
Lithium organic electrolyte single cells with fluorographite cathodes
[AD-739488] N72-27071
Comparing effects of positive Gy acceleration on cardiovascular and respiratory functions in dogs under normal respiration in air, and when totally immersed in oxygenated fluorocarbon
[NASA-CR-127262] N72-27078
FLUX [RATE]
Estimates of energetic electron and proton fluxes in Jupiter radiation belts, dose rates for shielding, and radiation lifetimes of electronic circuits
N72-27854
Uncertainties in electron and proton flux models and resulting uncertainties in fluences for Jupiter flyby missions
N72-27857
Electron and proton energies, densities, and fluxes from 1 to 6 Jupiter radii
N72-27863
Upper limits of electron and proton fluxes in Jupiter radiation belts, using radial diffusion for getting solar wind fluxes into inner regions of belts
N72-27868
FLYBY MISSIONS
Systematic procedure for identifying spatial regimes of various modes of radio wave propagation in Jupiter magnetosphere to be ecountered by flyby missions
N72-27869
FOG
Application of downwash from helicopter rotors for dissipation of fog
[AD-739487] N72-27042
FOLIAGE
Using remote sensors for controlled studies of reflectance and emittance characteristics of foliage on trees subjected to stresses
[NASA-CR-127420] N72-27375
FORCE DISTRIBUTION
Forward speed effect on lift power of two dimensional jet ground effect support
N72-27006
Force parameters in rotary extrusion of thin walled shells of revolution
[NLL-M-21379-[5828.4F]] N72-27489
FORESTS
Forest density determined from aerial photographs, protection of farm crops against hail, and other scientific and technical research in Eastern Europe
[JPRS-56426] N72-27981
FORTRAN
FORTRAN extended graph algorithmic language for Univac 1108
[NASA-CR-127263] N72-27206
Computer technique for data reduction and correction in quantitative electron probe microanalysis
[NBS-TN-719] N72-27209
Trajectory computations in FORTRAN for engineering-type application, using differential equations
[NASA-TM-X-64679] N72-27891
FORWARD SCATTERING
Fixed pole and Regge pole terms in formula for forward Compton scattering
[RIFP-148] N72-27760
FRACTURE MECHANICS
Fracture and stress-strain behavior of ATJ-S graphite under uniaxial, biaxial, and triaxial stresses
[AD-739204] N72-27604
Fracture mechanics approach to thermal shock resistance of brittle materials
[AD-739494] N72-27609
Characteristics of drop-weight tear tests to determine mechanical properties of plates and large tubes
[NLL-T1512/ERS/72-[9022.305]]
N72-27943
Analysis of stress intensity factor of half-plane crack extending non-uniformly in isotopic elastic solid subjected to general loading
[AD-739557] N72-27957
FRACTURE STRENGTH
Fracture strength of high strength steel HFX 103 after quenching and annealing for weldability assessment
[T-MITT-4/71] N72-27579
Liquid environment effect on ceramics fracture toughness noting plastic flow induction
[WB-5/71] N72-27956
FRACTURING
Fracturing in solid rocket propellants
[AD-739355] N72-27812
FRAUNHOFER LINE DISCRIMINATORS
Response of Fraunhofer line discriminator to pesticide granules
[NASA-CR-127528] N72-27351
Discrimination of sodium D2 line in surficial desert and semidesert deposits of California and Arizona
[NASA-CR-127529] N72-27353
FREE CONVECTION
Navier-Stokes equations for natural convection in enclosure with localized heating from below
[PB-208111] N72-27334
FREE ELECTRONS
Electron generation and recombination processes in semiconductors
[AD-739978] N72-27809
FRENCH SATELLITE
Specifications for holographic gratings for spectrophotometer onboard French D2A polar satellite for Lyman beta studies
N72-27449
Onboard solar sensors for French D2B satellite attitude control
N72-27458
FREQUENCY ANALYZERS
Audio frequency analysis circuit for determining, displaying, and recording frequency of sweeping audio frequency signal
[NASA-CASE-NPO-11147] N72-27408
FREQUENCY DISTRIBUTION
Statistical analysis of frequency distribution in mineral oil pipeline pressure variations
[FB-93] N72-27325
FREQUENCY DIVIDERS
Modification of conventional digital frequency divider to extend frequency range
[NASA-CASE-LAR-10730-1] N72-27255
FREQUENCY RANGES
Modification of conventional digital frequency divider to extend frequency range
[NASA-CASE-LAR-10730-1] N72-27255
FREQUENCY SCANNING
Ultrasonic adjustable scanner for flaw detection in flat or radial panels of honeycomb structure with welded seams
[NASA-CASE-MFS-20335-1] N72-27421

FREQUENCY STABILITY
Application of atomic oscillators for direct measurement of effects of gravitation on time to verify equivalence principle
[NASA-CR-127429] N72-27363
Precision measurement techniques applied to frequency and time standards and time synchronizations - Vol. 5
[NBS-SP-300-VOL-5] N72-27523
FREQUENCY STANDARDS
Precision measurement techniques applied to frequency and time standards and time synchronizations - Vol. 5
[NBS-SP-300-VOL-5] N72-27523
Absolute hydrogen hyperfine transition frequency of atomic hydrogen maser clock
[NASA-TM-X-65936] N72-27549
FRETTING CORROSION
Wear analysis on graphite bearings operating in lubrication containing nitric acid
[AD-738746] N72-27539
FRICTION
Effect of vapor and liquids on friction and wear of molybdenum disulfide
[NLL-RISLEY-TR-2363-[9091.9F]] N72-27146
FRONTS [METEOROLOGY]
Analysis of cold fronts in Sea of Japan
[NLL-M-22454-[5828.4F]] N72-27639
FUNCTIONAL ANALYSIS
Functional performance analyses on Skylab foot controlled maneuvering unit
[NASA-CR-61386-APP-R] N72-27920
FUSES [ORDNANCE]
Meteorological radar surveillance of atmospheric conditions during artillery tests conducted in Panama
[AD-739485] N72-27666
FUSION WELDING
Resistance projection welding of large cross section joints for machine components N72-27507

G

GALAXIES
Infrared photometry of galactic and quasar nuclei
[AD-739196] N72-27901
GALLIUM ARSENIDES
Czochralski technique for improving growth and characterization of GaAs and mixed III and V semiconductor crystals
[AD-739374] N72-27807
GAMMA RAYS
Sensitivity changes in neutron detectors in intense gamma fields
[NLL-WH-TRANS-324-[9091.9F]] N72-27418
Effect of gamma irradiation on first constant of magnetic crystallographic anisotropy of single crystals of nickel and nickel copper ferrites
[AD-739286] N72-27805
GAS CHROMATOGRAPHY
Gas chromatographic analysis of alcohols and mercaptans
[NASA-TT-F-14348] N72-27153
Operational efficiency of countercurrent continuous gas chromatograph with enlarged processing column
[NLL-RTS-6992] N72-27407
GAS COOLING
Local obstruction influence on heat transfer between packed bed sphere and coolant gas
[VKI-TN-80] N72-27725
GAS DETECTORS
Ethylene chemiluminescence ozone detector for smog chamber studies
[BM-RI-7650] N72-27420
Flowmeter and leak detector for gaseous flow detection in space environments N72-27519
GAS DISCHARGE TUBES
Monochromator excited by ultrahigh frequency electrodeless discharge for Lyman alpha calibrating N72-27463
Development of discharge tubes with various metal components to determine suitable material for cold cathode of carbon dioxide laser
[NASA-CR-122441] N72-27550
GAS DISCHARGES
Gas discharges in crossed nonuniform electric and transverse magnetic fields
[AD-739290] N72-27780
Method for determining gas temperature profile and decay, using temperature dependence of line absorption
[AD-739491] N72-27783
GAS DISSOCIATION
Nitrogen atom generation by nitrogen gas flow over heated filaments
[AD-739520] N72-27164
GAS DYNAMICS
Numerical analysis of time dependent gas dynamics and accuracy in regions of continuous flow N72-27304
Establishment of Joule-Thomson inversion curves for various gases using equations of state
[NASA-TN-D-6807] N72-27965
GAS EXPANSION
Establishment of Joule-Thomson inversion curves for various gases using equations of state
[NASA-TN-D-6807] N72-27965
GAS FLOW
Pressurized inert gas feed for lighting system
[NASA-CASE-KSC-10644] N72-27227
Numerical analysis of viscous gas flow and shock formation N72-27300
Numerical analysis of three dimensional ideal gas flow and Euler equations of motion N72-27307
GAS HEATING
Nitrogen atom generation by nitrogen gas flow over heated filaments
[AD-739520] N72-27164
GAS IONIZATION
Relaxation profiles of ionizing shock wave in argon
[CP-36] N72-27772
GAS LASERS
X ray and laser irradiation of glycol sulfate crystals in relation to nucleation and spontaneous polarization
[NLL-TRANS-855-[9022.64]] N72-27148
GAS MASERS
Absolute hydrogen hyperfine transition frequency of atomic hydrogen maser clock
[NASA-TM-X-65936] N72-27549
GAS STREAMS
Interaction between sonic two dimensional secondary injection jet and supersonic stream with axial pressure gradient N72-27288
Supersonic mixing and combustion of coaxial hydrogen-air streams in duct
[AD-739866] N72-27971
GAS TEMPERATURE
Method for determining gas temperature profile and decay, using temperature dependence of line absorption
[AD-739491] N72-27783
GAS TURBINE ENGINES
Test and evaluation of antifriction bearings for use in turbine-alternator-compressor units of Brayton cycle electric power supply
[NASA-TM-X-68095] N72-27529
Thermal stress analysis on roller bearings in gas turbine compressor rotor
[AD-739209] N72-27537
GAS TURBINES
Development and evaluation of fluidic turbine inlet gas temperature sensors
[NAL-TR-265] N72-27428
Thermal and oxidative stability test methods for fire resistant phosphate ester lubricants of gas turbines
[AD-738477] N72-27543
GASEOUS DIFFUSION
Monte Carlo method for variance reduction in analysis of rarefied gas diffusion between parallel walls
[NASA-TM-X-68094] N72-27156
GASES
Thermal conductivity of neon, krypton, xenon, and vapors of alkali metals with dissociation calculation and thermophysical properties of gases
[AD-738737] N72-27161
GEIGER COUNTERS
Geiger-Mueller tube epxeriment package for Pioneers F and G to study energetic electrons and protons in Jupiter magnetosphere N72-27871
GEMINI FLIGHTS
Gemini and Apollo observations of geologic structure of Baja California
[NASA-CR-127259] N72-27356
GENERAL AVIATION AIRCRAFT
Application of unconventional wing pivoting about spanwise axis forward of aerodynamic center for gust alleviation in general aviation aircraft
[NASA-CR-2046] N72-26996
GEOCHEMISTRY
Chemical variability of Kilauea and Mauna Loa lava and model for origin of Kilauea
[USGS-PP-735] N72-27366
Geochemical mapping of lunar surface by Apollo 16 spacecraft for Al, Mg, and Si
[NASA-TM-X-65918] N72-27880
GEODESY
Least squares method for kinematical geodesy
[AD-737799] N72-27402
GEODETIC COORDINATES
Gravimeter measurements and differential leveling for estimating gravity anomalies
[AD-737589] N72-27541
GEOLOGY
Gemini and Apollo observations of geologic structure of Baja California
[NASA-CR-127259] N72-27356
Research in economic geology and extractive metallurgy
[REPT-9] N72-27367
Geology, climatology, land use, and cadastral aspects of Nicaragua
[PB-207385] N72-27401
GEOMAGNETIC TAIL
Explorer 33 magnetic field observations of sudden impulse propagation in geomagnetic tail and magnetosheath
[NASA-CR-127421] N72-27376
GEOMAGNETISM
Methods and instruments for mapping distribution and intensity of earth magnetic field
[NASA-TT-F-14407] N72-27354
Electron precipitation in inner radiation belt in geomagnetic field deformation
[ESRO-SN-117] N72-27382
GEOMETRY
Preprocessing of Meteosat transmitted images, noting satellite rotation and displacement perturbation vs image geometry quality N72-27469
GEOPHYSICS
Soviet bloc research in astronomy, meteorology, oceanography, geology, and space science - 30 June 1972
[JPRS-56398] N72-27884
Soviet bloc research in astronomy, meteorology, oceanography, geology, and space science - 7 July 1972
[JPRS-56444] N72-27890
GEOPOTENTIAL
Analysis of 15th-order geopotential coefficients obtained from orbit of Transit 1B
[RAE-TR-72003] N72-27899
Real world geopotential model with low orbit trajectories
[AD-739492] N72-27940
GERMANIUM
Measured output of germanium photovoltaic cell with erbium oxide and silicon carbide radiators
[AD-739489] N72-27072
GERMANY
Meteorological observations by network of weather stations in Odenwald area of Germany
[REPT-128] N72-27635
GERMINATION
Thermal activation and relative humidity effects on spore pregermination
[NASA-CR-127525] N72-27077
GLASS
Electron conduction in glass and preparation of conducting glasses
[NLL-TRANS-852-[9022.64]] N72-27598
Correlation of abrasion, microindentation hardness and maximum fracture velocity of optical glasses in liquids
[WB-2/71] N72-27603
GLASS FIBERS
Development of procedure for repairing fiberglass structures which retains geometry and strength of original structure
[NASA-CASE-LAR-10416-1] N72-27527
GLAZES
Compressive stress effects on surface hardness of glazes
[NLL-T-1509-[9022.305]] N72-27595
GLIDE PATHS
Performance tests of instrument landing system localizer to include system and monitor stability and monitor operation under degraded system performance
[FAA-RD-72-50] N72-27694
Analysis of pilot performance in establishing specific glide path by reference to oblong diamond marks on runway
[FAA-NA-72-57] N72-27702
GLOBAL ATMOSPHERIC RESEARCH PROGRAM
Impact of GARP on environment
[NASA-TM-X-68546] N72-27632
GLYCOLS
X ray and laser irradiation of glycol sulfate crystals in relation to nucleation and spontaneous polarization
[NLL-TRANS-855-[9022.64]] N72-27148
GOE SATELLITES
Design of flight control system for launch vehicle models of geostationary satellite
[NAL-TR-264] N72-27932
GOVERNMENT PROCUREMENT
Development of model for analyzing and controlling procedures for acquisition of weapon systems
[P-4794] N72-27984
GRADIENTS
Sound ray theory for analyzing effects of horizontal gradients on acoustic wave propagation velocity in channels N72-27727
GRAPHITE
Lithium organic electrolyte single cells with fluorographite cathodes
[AD-739488] N72-27071
Graphite particle cementation in electrically conductive fluidized bed
[NLL-TRANS-746-1149-[9022.401]] N72-27490

Fracture and stress-strain behavior of ATJ-S graphite under uniaxial, biaxial, and triaxial stresses
[AD-739204] N72-27604

GRATINGS [SPECTRA]
Holographic gratings for Lyman alpha radiation
N72-27448
Specifications for holographic gratings for spectrophotometer onboard French D2A polar satellite for Lyman beta studies
N72-27449
Computation of aberrations of concave grating and optimization of resolution by masking grating parts
N72-27450

GRAVIMETRY
Gravimeter measurements and differential leveling for estimating gravity anomalies
[AD-737589] N72-27541

GRAVITATION THEORY
Conservation laws and preferred frames in relativistic gravity
[NASA-CR-127277] N72-27358
Preferred-frame theories of gravity and extended parameterized post-Newtonian formalism
N72-27359
Experimental evidence to rule out preferred-frame theories of gravity
N72-27360

GRAVITATIONAL EFFECTS
Application of atomic oscillators for direct measurement of effects of gravitation on time to verify equivalence principle
[NASA-CR-127429] N72-27363
Collective oscillations of spherically symmetric systems of gravitational particles rotating in circular trajectories
[NASA-TT-F-14413] N72-27751

GRAVITATIONAL FIELDS
Orbital theory analysis and properties of gravitational potential function in relation to photogrammetry
N72-27845

GRAVITY ANOMALIES
Gravimeter measurements and differential leveling for estimating gravity anomalies
[AD-737589] N72-27541

GRAVITY WAVES
Multisensor arrays for long period acoustic gravity waves in atmosphere
[AD-739260] N72-27387

GREAT BRITAIN
Optical satellite tracking of Cosmos and other artificial satellites, Edinburgh, Feb. 1972
[ROE-STS-123] N72-27936
Optical satellite tracking of Cosmos and other artificial satellites, Edinburgh, Mar. 1972
[ROE-STS-124] N72-27937

GRIDS
Reduction of accelerator grid erosion due to direct impingement of ion beam
[NASA-TM-X-68096] N72-27824

GROOVES
Spiral groove seal for rotating shaft
[NASA-CASE-XLE-10326-4] N72-27522

GROUND STATE
Numerical analysis of Hartree-Fock diagrams for ground state energies in perturbation field theory
[NASA-TT-F-14401] N72-27754

GROUND STATIONS
Ground based reception of Cosmos-381 satellite signals from magnetically conjugate domain
N72-27180

GROUND WATER
Airborne gamma surveys for determining water equivalent of snow cover
[TT-70-50093] N72-27662

GUIDANCE SENSORS
Application of guidance laws to control and guidance of tactical missiles to reduce amount of miss distance
N72-27689
Characteristics of command-to-line-of-sight guidance and semi-active homing missile systems applied to guidance and control of tactical missiles
N72-27692

GUIDE VANES
Performance and distortion tolerance of 1500 ft/sec tip speed transonic fan stage with variable geometry inlet guide vanes and variable stagger stator
[NASA-CR-72880] N72-27818
Design and development of movable turbine inlet guide vanes to provide aerodynamic choking for jet engine
[NASA-CASE-LAR-10642-1] N72-27820

GUST ALLEVIATORS
Application of unconventional wing pivoting about spanwise axis forward of aerodynamic center for gust alleviation in general aviation aircraft
[NASA-CR-2046] N72-26996

GUST LOADS
Fatigue crack propagation in Fokker F-28 full-scale wing structure under cyclic gust flight simulation loading
[NLR-TR-71043-U] N72-27955

GUSTS
Transonic wind tunnel calibration of dual system gust measuring probe
[ARL/A-NOTE-334] N72-27426

GYROCOMPASSES
Error analysis for inertial navigation system using azimuth gyrocompass and directional gyroscope
N72-27696

GYROSCOPES
Performance tests on gyroscope and its fluid amplifier
[LRBA-E204-PV-5] N72-27471
Analysis and comparison of two types of strapdown gyroscope rebalance electronic systems in terms of accuracy and resolution
N72-27678
Error analysis and accuracy of gyroscopic instruments used in inertial navigation
[JPRS-56387] N72-27695
Error analysis for inertial navigation system using azimuth gyrocompass and directional gyroscope
N72-27696
Effect of gyromotor magnetic dispersion field on accuracy of fluid floated gyroscopic instruments
N72-27699
Development of frequency model for single degree of freedom rate integrating gyroscope using Eulerian formulation
[AD-739182] N72-27711

GYROSCOPIC STABILITY
Characteristics of strapdown inertial platforms using redundant two degree of freedom gyros
N72-27676
Application of attitude transformation algorithms for strapdown inertial platforms and realization by digital differential analyzers
N72-27677
Effects of orbital perturbations on responses of gyroscope system for testing relativity theory in polar orbiting satellite
[AD-739500] N72-27712

GYROSTABILIZERS
Feasibility of neglecting small time constants of control systems of uniaxial gyrostabilizer
N72-27697

H

HADRONS
Inclusive and exclusive multiparticle spectra for simple models of high energy hadronic interactions
[ILL-[TH]-72-7] N72-27758
Field model for weak and electromagnetic interactions of leptons and hadrons with charge parity violations
[TR-72-084] N72-27768

HAIL
Environmental impact survey of hail in Colorado, Wyoming, and Nebraska
[PB-207539-F] N72-27661
Forest density determined from aerial photographs, protection of farm crops against hail, and other scientific and technical research in Eastern Europe
[JPRS-56426] N72-27981

HALF LIFE
Equatorial electron energy, number density, and radiative half life in Jupiter magnetosphere, based on synchrotron model with Maxwellian energy distribution
N72-27853

HALF PLANES
Approximations for difference problem with oblique derivitive in half plane
[NASA-TT-F-14346] N72-27617

HALOGEN COMPOUNDS
Effects of bromotrifluoromethane inhalation and epinephrine challenge on cardiovascular system
[AD-739699] N72-27098

HARDENING [MATERIALS]
Derivation of equation to predict rolling-element fatigue lives of through-hardened bearing steels combining effects of material hardness, carbide factor, and bearing temperature
[NASA-TM-X-68078] N72-27573

HARMONIC EXCITATION
Effect of radial wave functions for baryons in symmetric quark model
[TR-72-122] N72-27765
Radial baryon excitation modes in symmetric quark model
[TR-72-088] N72-27766

HARMONIC OSCILLATORS
Radial baryon excitation modes in symmetric quark model
[TR-72-088] N72-27766

HARTREE APPROXIMATION
Numerical analysis of Hartree-Fock diagrams for ground state energies in perturbation field theory
[NASA-TT-F-14401] N72-27754

HAWAII
Chemical variability of Kilauea and Mauna Loa lava and model for origin of Kilauea
[USGS-PP-735] N72-27366

HAZARDS
Lightning triggered by man and lightning hazards
N72-27101

HEARING
Human eardrum rupture and hearing loss injuries from nuclear explosions
[AD-737643] N72-27092
Hearing, bioacoustics, and biomechanics for biodynamic models - conference
[AD-739501] N72-27140

HEAT BALANCE
Water and heat balance effects on moisture content of slope soils
[NLL-M-22458-[5828.4F]] N72-27344

HEAT BUDGET
Heat balance equations for studying diurnal heat budget of thermosphere
[NASA-TM-X-65928] N72-27364

HEAT EXCHANGERS
Heat exchanger tube-to-tubeplate welded joints for thin walled tubes
N72-27506

HEAT RESISTANT ALLOYS
Compositional limits of gamma and gamma prime phases in nickel base superalloys
[NASA-CR-120940] N72-27575
Long term stability of Nichrome based heat resistant composite, reinforced with tungsten fibers
[NLL-TRANS-746-1148-[9022.401]]
N72-27596
High temperature tests to determine oxidation resistance and mechanical properties retention of porous alloy materials suitable for transpiration cooled vanes
[NASA-CR-1999] N72-27819

HEAT SHIELDING
Labor costs and techniques for maintenance of thermal protection system for space shuttle applications
[NASA-CR-112034-1] N72-27922

HEAT TRANSFER
Viscosity coefficient characterization by mass or heat diffusion coefficients
[NLL-T-1507-[9022.305]] N72-27289
Periodic crossflow effects on heat transfer in laminar axisymmetric boundary layer
[TAE-146] N72-27320
Extent of transition zone and heat transfer during mixed flow of air in pipes
[AD-739210] N72-27328
Formulas for laminar compressible similar boundary layers with heat transfer, adverse pressure gradient, and constant cross flow
[AD-739864] N72-27335
Electron and neutral particle concentration and temperature for computing heat influx to electron gas
N72-27378
Development of thermocouple instrument for measuring temperature of wall heated by flowing fluid without disturbing boundary layer
[NASA-CASE-XLE-05230] N72-27410
Electric heaters for simulating nuclear fuel elements during heat transfer experiments
[NLL-CE-TRANS-5885-[9022.09]]
N72-27715
Local obstruction influence on heat transfer between packed bed sphere and coolant gas
[VKI-TN-80] N72-27725
Cryogenic properties of solids, slush hydrogen heat transfer, and solid hydrogen
[NASA-CR-127275] N72-27730
Wind tunnel tests for heat transfer distributions on LMSC 040C and 040A-L4 Delta wing space shuttle orbiter
[NASA-CR-120072] N72-27935
Evaluation of model shadow shield thermal protection system and support members for possible application to shielding of cryogenic tanks to reduce heat transfer
[NASA-TM-X-68099] N72-27966

HEAT TRANSFER COEFFICIENTS
Local obstruction influence on heat transfer between packed bed sphere and coolant gas
[VKI-TN-80] N72-27725

HEAT TREATMENT
Relation between creep rupture strength and electron microstructure of Cr-Mo steels after heat treatment
[NLL-CE-TRANS-5594-[9022.09]]
N72-27560
Microstructure and mechanical and tensile properties of thermomechanically processed titanium alloys
[AD-739365] N72-27589

HEATERS
Electric heaters for simulating nuclear fuel elements during heat transfer experiments
[NLL-CE-TRANS-5885-[9022.09]]
N72-27715

HEATING EQUIPMENT
Design and performance of prototype portable heat source for providing thermal insulation in diving suit
N72-27122

HELICOPTER CONTROL
Design, development, and evaluation of three-axis hydrofluidic stability augmentation system for UH-1 helicopter
[AD-739559] N72-27045

HELICOPTER PERFORMANCE
Compilation of technical reports on missile design, missile guidance, helicopter stability, VTOL aircraft, and wind tunnel design - Vol. 3
[SBN-11-470153-9] N72-26995

HELICOPTERS
Measurement of aerodynamic damping moment in pitch for hovering model helicopter rotary wing
[NAL-TR-256] N72-27028
Application of downwash from helicopter rotors for dissipation of fog
[AD-739487] N72-27042
Development of criteria for application of composite materials in construction of helicopter synchronizing drive shafts
[AD-739429] N72-27043
Analysis of secondary power system for use with advanced rotary wing aircraft for reliable production of electric power
[AD-739480] N72-27069

HELIUM
Bibliography on helium and alpha particles
[BM-IC-8523] N72-27155
Behavior of nuclear power plant pressure vessel insulations in helium
[NLL-WH-TRANS-321-[9091.9F]] N72-27716

HELIUM-NEON LASERS
Opthalmologic examinations for determining retina damage caused by helium-neon laser boresights
[AD-738629] N72-27087
Shock tube hypersonic gas flow measurements using helium-neon laser differential interferometer
[ISL-14/71] N72-27324

HIGH PRESSURE
Plasticity and ductility of metals subjected to high pressure
[NLL-NEL-TT-2371-[6075.461]] N72-27564

HIGH RESOLUTION
High resolution three part bolometer for far infrared detection N72-27438

HIGH SPEED
High speed compact, and robust microchannel plate photomultiplier for use as onboard radiation detectors N72-27443

HIGH STRENGTH ALLOYS
Mechanism of fatigue enhancement in selected high strength aluminum alloys related to unique microstructures
[AD-738450] N72-27584

HIGH STRENGTH STEELS
Fracture strength of high strength steel HFX 103 after quenching and annealing for weldability assessment
[T-MITT-4/71] N72-27579

HIGH TEMPERATURE
Research and development in high temperature welded structures N72-27493
High temperature and humidity effects on plastic encapsulated semiconductors
[AD-739473] N72-27806

HIGH TEMPERATURE RESEARCH
Strain rate and elevated temperature effects on mechanical properties of Cr-Mo-V steels
[AD-739516] N72-27591
Gas core reactor power transient analysis featuring high temperatures
[NASA-TM-X-68089] N72-27723

HIGH TEMPERATURE TESTS
High temperature tests to determine oxidation resistance and mechanical properties retention of porous alloy materials suitable for transpiration cooled vanes
[NASA-CR-1999] N72-27819

HIGH VACUUM
Material transfer from electrodes during high vacuum pulse breakdown, using copper cathode
[AD-739208] N72-27744

HIGH VOLTAGES
Dimensions of anti-corona electrodes for high voltage test equipment
[NLL-CE-TRANS-5794-[9022.09]] N72-27247

HIGHWAYS
Updating maps of transportation networks by space photography
[NASA-CR-127530] N72-27422

HILBERT SPACE
Solution of nonlinear Lee nuclear field theoretical model in Hilbert space
[NOTA-INTERNA-356] N72-27769

HISTORIES
Aeronautical history leading to American space exploration
[PUBL-70-10] N72-27980

HOLOGRAPHY
Holographic gratings for Lyman alpha radiation N72-27448
Specifications for holographic gratings for spectrophotometer onboard French D2A polar satellite for Lyman beta studies N72-27449

HONEYCOMB STRUCTURES
Quality control of lightweight cast honeycomb structure mirrors for infrared astronomical telescope detectors N72-27452
Thermal conductivity of honeycomb sandwich panels for spacecraft structures
[NLR-TR-71031-U] N72-27967

HORIZON SCANNERS
Performance characteristics of thermopiles as infrared horizon scanners for satellite attitude control N72-27439
Specifications for IR transhorizon scanner to control geostationary satellite attitude during transfer orbit passage N72-27460
Specifications for onboard earth horizon scanner to control three axis stabilized Symphonie satellite N72-27461
Attitude simulator for performance prediction of infrared horizon scanner for onboard geostationary satellite, noting rotating and static simulation N72-27462

HORIZONTAL TAIL SURFACES
Development, stress analysis, and manufacturing of horizontal stabilizer for A-4 aircraft using graphite-epoxy laminates in primary structure
[AD-738900] N72-27040

HOT-FILM ANEMOMETERS
Measuring values characterizing structure of turbulent flow by hot-wire anemometers
[NLL-TRANS-T-1521-[9022.305]] N72-27413

HOT-WIRE ANEMOMETERS
Measuring values characterizing structure of turbulent flow by hot-wire anemometers
[NLL-TRANS-T-1521-[9022.305]] N72-27413
Hot-wire anemometer measurement of jet fluctuations in mass flow in gun tunnel
[TT-7205-REV] N72-27419
Two-channel constant-temperature hot-wire anemometer and mean-product computer
[AD-739337] N72-27655

HOUSINGS
Cryogenic gyroscope housing with annular disks for gas spin-up
[NASA-CASE-MFS-21136-1] N72-27731

HUMAN BEINGS
Existence of hypocalcemic factor in human thyroids
[NASA-TT-F-14341] N72-27079

HUMAN BODY
Neck cooling collar for improved thermal comfort in hot weather N72-27126
Gas chromatography and chelation for metal trace determinations in water and human body
[AD-739865] N72-27166

HUMAN CENTRIFUGES
Simulation of dynamic spin of F-4 aircraft under pilot control using human centrifuge facility
[AD-739326] N72-27278

HUMAN FACTORS ENGINEERING
Six degree of freedom simulator tests to determine effects of motion cues on short takeoff and landing aircraft approach
[NASA-CR-114458] N72-27032
Steady state and transient temperature distributions in human thigh covered with cooling pad
[NASA-CR-127523] N72-27084
Conference on portable life support systems for human protection
[NASA-SP-302] N72-27106
Portable air supply and monitoring system for personnel working on offshore platform piling N72-27123
Human factors engineering viewpoint of psychophysiological measurements applied to maintainability evaluation of equipment design
[AD-739437] N72-27137
Response time to vibrotactile stimulus in relation to signal amplitude and frequency variation
[AD-739433] N72-27139
Computer terminal network for transparent stimulation of user of on-line retrieval system
[NBS-TN-732] N72-27217

HUMAN PERFORMANCE
Stimulus durations and individual differences approach for monitoring performance across sense modes
[AD-737735] N72-27089
Analysis of arm performance subjected to external load during crank turning task
[AD-739478] N72-27096
Effect of noise and temperature on human performance of simple manual dexterity task
[AD-739432] N72-27097
Gravity simulation by rotation and effects on human performance
[NASA-CR-111866] N72-27104
Reliability of complex tracking task performed concurrently with other tasks or tracking alone condition
[FAA-AM-72-21] N72-27105

HUMAN REACTIONS
Tests of broadband high intensity noise on human equilibrium
[AD-737826] N72-27093

HUMAN TOLERANCES
Analysis of survival following crashes of military aircraft and identification of areas for improvement in structural design
[AD-739370] N72-27044
Human tolerance to external respiratory resistance for design of breathing apparatus N72-27127

HUMIDITY
Thermal activation and relative humidity effects on spore pregermination
[NASA-CR-127525] N72-27077
High temperature and humidity effects on plastic encapsulated semiconductors
[AD-739473] N72-27806

HUMIDITY MEASUREMENT
Effect of water absorption on infrared reflection used as means of continuous humidity measurement
[NASA-TT-F-14333] N72-27640

HUYGENS PRINCIPLE
First and second moments of optical wave propagating in random medium and solution equivalence of Dyson and Bethe-Salpeter equation and Huygens-Fresnal principle
[AD-739185] N72-27746

HYBRID COMPUTERS
Computer systems designed for simulating large complex systems
[P-4791] N72-27214
Hybrid computers and digital simulation languages for continuous system dynamics analysis
[NASA-CR-127252] N72-27220

HYDRATES
Nickel-tin alloy deposition with hydrazine hydrate
[NLL-TRANS-746-1196-[9022.401]] N72-27572

HYDRAULIC TEST TUNNELS
Analysis of helicopter rotor wake patterns using water tunnel test facility
[AD-739946] N72-27052

HYDRAZINES
Nickel-tin alloy deposition with hydrazine hydrate
[NLL-TRANS-746-1196-[9022.401]] N72-27572

HYDROCARBON COMBUSTION
Analysis of confined laminar flames with emphasis on parameters which determine flame geometry and emission of soot
[NLL-T-1530-[9022.305]] N72-27960

HYDROCARBON FUELS
Analysis of confined laminar flames with emphasis on parameters which determine flame geometry and emission of soot
[NLL-T-1530-[9022.305]] N72-27960
Detonation characteristics of heterogeneous systems consisting of petroleum and oxygen contained in pipes
[NLL-298-[8660.5]] N72-27961

HYDROCARBONS
Effects of bromotrifluoromethane inhalation and epinephrine challenge on cardiovascular system
[AD-739699] N72-27098

HYDRODYNAMIC EQUATIONS
Scale analysis with consideration of filtering and approximation of hydrothermodynamic equations for different meteorological scales
[NLL-M-22384-[5828.4F]] N72-27634

HYDRODYNAMICS
Numerical approximation of non-Cauchy-Kowaleska systems in hydrodynamics N72-27295
Solving equations of hydrothermodynamics for weather forecasting
[AD-739239] N72-27657

HYDROGEN
Anion effect in hydrogen adsorption on platinum electrode
[NASA-TT-F-14361] N72-27152
Kinetic and energetic behavior of vibrationally excited hydrogen molecules
[AD-739524] N72-27165
Hydrogen embrittlement and carbide disintegration of metals used in pressure vessels N72-27494
Analysis of metal embrittlement in hydrogen environments
[NASA-TM-X-68088] N72-27574
Hydrogen-dislocation interactions in alpha titanium aluminum alloys studied via internal friction measurements at high temperatures
[AD-739696] N72-27593
Cryogenic properties of solids, slush hydrogen heat transfer, and solid hydrogen
[NASA-CR-127275] N72-27730

HYDROGEN ATOMS
Atomic hydrogen hyperfine transition in free atom beam standard
[NASA-TM-X-65932] N72-27763

HYDROGENATION
Vacuum extraction of aluminum during interaction with water
[NLL-M-21374-[5828.4F]] N72-27145
HYDROLOGY
Use of computers for hydrological research
[NLL-M-22333-[5828.4F]] N72-27340
Automated data processing for hydrological research
[NLL-M-22344-[5828.4F]] N72-27341
Hydrological computer codes and algorithms for water management and snow surveys
[NLL-M-22339-[5828.4F]] N72-27342
Computer processing of hydrological gauge data
[NLL-M-22341-[5828.4F]] N72-27343
HYDROMETEOROLOGY
Automatic methods based on computers for processing hydrochemical data for USSR hydrometeorological service
[NLL-M-22307-[5828.4F]] N72-27270
HYPERFINE STRUCTURE
Atomic hydrogen hyperfine transition in free atom beam standard
[NASA-TM-X-65932] N72-27763
HYPERPLANES
Intersecting all edges of centrally symmetric polyhedra by hyperplanes
[AD-739711] N72-27628
HYPERSONIC FLIGHT
Approximate shock wave model for studying radial density distribution and refractive index in wake of shell in hypersonic flight
[ISL-16/71] N72-27323
HYPERSONIC FLOW
Shock tube hypersonic gas flow measurements using helium-neon laser differential interferometer
[ISL-14/71] N72-27324
Modulated force probe for drag coefficient measurements of spheres in hypersonic noncontinuum flow
[AD-739250] N72-27327
HYPERSONIC SPEED
Development of technique for launching aerodynamic models at hypersonic speed using helium-operated light gas gun facility
[CP-34] N72-27275
Analysis of effect of high injection rates on laminar boundary layer and relation to atmospheric entry conditions
[JPRS-56437] N72-27322
Location of laminar-turbulent transition in wake of 22-deg half angle sharp cones at hypersonic speed
[AD-739318] N72-27326
Wind tunnel tests to determine pressure distribution on space shuttle scale model in abort mode configuration under various aerodynamic conditions -Vol. 1 Pt. B
[NASA-CR-120008-VOL-1-PT-B] N72-27925
HYPERVELOCITY FLOW
Characteristics of elliptically shaped leading edges of wings and fins for reduction of aerodynamic heating of reentry vehicles under hypervelocity flight conditions
[AD-739869] N72-27051
HYPERVELOCITY WIND TUNNELS
Axisymmetric nozzle for producing test section flow in hypersonic test facility
[NASA-TM-X-64664] N72-27273
HYSTERESIS
Formation and breakdown of water film moving over solid surfaces
[NASA-TM-X-68071] N72-27291
Hysteresis losses of magnetic materials in rotating magnetic fields due to Bloch walls
[NLL-CE-TRANS-5686-[9022.09]] N72-27729

I

ICE
Construction, calibration, and operation of Bunsen-type ice calorimeter
[AD-739186] N72-27475
Ice crystal terminal velocities for calculating ice crystal growth in clouds, evaporation in subcloud regions, and precipitation rates
[NASA-CR-127428] N72-27645
ICE NUCLEI
Microphysical diffusion model of rapid glaciation in supercooled clouds for studying precipitation from artificial seeding of layer-type orographic clouds
[TN-42] N72-27643
ILLUMINATION
Effects of noise and illumination on human motor performance
[AD-739474] N72-27095
IMAGE CONVERTERS
Onboard supervidicon-fiber optical assembly of image converter/integrator vidicon for UV stellar radiation N72-27445
Pseudocolor separation process for gray interpretation in black and white conversion to chromatic image
[P-4804] N72-27738
IMAGE INTENSIFIERS
Microchannel electron multiplier array for double proximity focusing image tube design N72-27442
IMAGE TUBES
Microchannel electron multiplier array for double proximity focusing image tube design N72-27442
Performance limitations of onboard image analyzer, noting photoconductive and photoemissive tubes N72-27444
IMAGES
Optimization of image resolution by analog technique, compensating for aberration and diffraction defects N72-27470
Stereoscopic television system, including projecting pair of binocular images
[NASA-CASE-ARC-10160-1] N72-27728
IMAGING TECHNIQUES
Technique for estimating modulation transfer function of imaging system from edge response
[AD-739550] N72-27479
Microdensitometric film reduction, analysis, and display techniques applied to solar surface radiance and stellar spectral data
[AD-739868] N72-27482
Applications and operational constraints of conventional X radiographic and neutron imaging techniques N72-27517
IMPACT TESTS
Impact test of mobile nuclear reactor containment system
[NASA-TM-X-68103] N72-27721
IMPINGEMENT
Reduction of accelerator grid erosion due to direct impingement of ion beam
[NASA-TM-X-68096] N72-27824
IMPULSES
Explorer 33 magnetic field observations of sudden impulse propagation in geomagnetic tail and magnetosheath
[NASA-CR-127421] N72-27376
IN-FLIGHT MONITORING
Consolidated instrumentation plan to monitor performance and trajectory of Skylab 1 and Skylab 2
[NASA-TM-X-68520] N72-27918
INCOHERENT SCATTERING
Incoherent scattering cross sections of turbulent boundary layer adjacent to conducting plane and cylindrical surfaces
[AD-738632] N72-27193
INCOMPRESSIBLE FLOW
Implicit differential method for laminar, incompressible, steady state boundary layer
[NASA-TT-F-14363] N72-27314
Computer program for coordinates, incompressible inviscid section characteristics, and two dimensional drag-rise for NACA airfoils
[AD-738623] N72-27332
INCOMPRESSIBLE FLUIDS
Navier-Stokes equations of viscous incompressible fluid in bounded domain N72-27298
INDEPENDENT VARIABLES
Canonical satellite theory based on independent variables different from time
[ESRO-CR-[P]-76] N72-27625
INDEXES [DOCUMENTATION]
Annotated bibliography and indexes on Aerospace Medicine and Biology - May 1972
[NASA-SP-7011[102]] N72-27076
INDUCTANCE
Inductance device with vacuum insulation and materials of low gas entrapping capability
[NASA-CASE-LEW-10330-1] N72-27226
INDUSTRIES
Cryogenic and liquid metal technology applications in industry and for ground transportation
[NASA-TM-X-68092] N72-27737
INERTIAL GUIDANCE
Inertial guidance systems components and technology applied to control and guidance of tactical missiles N72-27690
Inertial guidance techniques for midcourse guidance and terminal guidance systems with application to control and guidance of tactical standoff missiles N72-27691
INERTIAL NAVIGATION
Proceedings of conference on principles of strapdown inertial navigation platforms
[NASA-CR-123710] N72-27673
Analysis principles of strapdown inertial platforms with emphasis on rebalance loop electronics and attitude algorithms N72-27674
Analysis of rebalance loop in strapdown inertial platform to show pulse shape, dc bias, and sampling process N72-27675
Error analysis and accuracy of gyroscopic instruments used in inertial navigation
[JPRS-56387] N72-27695
Error analysis for inertial navigation system using azimuth gyrocompass and directional gyroscope N72-27696
Characteristics of air navigation systems and methods for improving accuracy of navigation instruments and systems
[JPRS-56487] N72-27704
Kalman-Schmidt filters applied to optimal control of air submarine inertial navigation systems
[NASA-CR-127253] N72-27706
INERTIAL PLATFORMS
Characteristics of strapdown inertial platforms using redundant two degree of freedom gyros N72-27676
Application of attitude transformation algorithms for strapdown inertial platforms and realization by digital differential analyzers N72-27677
Analysis and comparison of two types of strapdown gyroscope rebalance electronic systems in terms of accuracy and resolution N72-27678
INFORMATION RETRIEVAL
Computer terminal network for transparent stimulation of user of on-line retrieval system
[NBS-TN-732] N72-27217
INFORMATION SYSTEMS
Binary coding of continuous time communications
[NASA-TT-F-13896] N72-27207
Operating procedure and controls and indicators for data compression/error correction digital test system
[NASA-CR-115643] N72-27219
Scientific and technical information systems and organizations in East Europe
[JPRS-56460] N72-27895
INFORMATION THEORY
USSR development of cybernetics and information
[JPRS-56465] N72-27179
INFRARED DETECTORS
High resolution three part bolometer for far infrared detection N72-27438
Cadmium telluride/mercury telluride photodiodes as onboard infrared detectors, noting hermetic sealing method N72-27440
Quality control of lightweight cast honeycomb structure mirrors for infrared astronomical telescope detectors N72-27452
INFRARED FILTERS
Research and development of bandpass filters for 2 to 20 micron range, noting transmission efficiency N72-27447
INFRARED IMAGERY
Remote sensing of flood damage in vicinity of Rapid City, South Dakota using color and infrared imagery
[SDSU-RSI-72-11] N72-27368
INFRARED RADIATION
Regression methods in five day mean height prediction at 500 mb using mean Nimbus 2 composited infrared data for identical periods in update procedure
[AD-739358] N72-27656
INFRARED REFLECTION
Effect of water absorption on infrared reflection used as means of continuous humidity measurement
[NASA-TT-F-14333] N72-27640
INFRARED SCANNERS
Performance and specifications of thermistor bolometers for sensing horizon for attitude control N72-27437
Performance characteristics of thermopiles as infrared horizon scanners for satellite attitude control N72-27439
Specifications for IR transhorizon scanner to control geostationary satellite attitude during transfer orbit passage N72-27460
Specifications for onboard earth horizon scanner to control three axis stabilized Symphonie satellite N72-27461
Attitude simulator for performance prediction of infrared horizon scanner for onboard geostationary satellite, noting rotating and static simulation N72-27462
Specifications and performance of mechanical scanning infrared radiometer for earth cloud cover onboard Meteosat N72-27467
INFRARED SPECTROSCOPY
Infrared photometry of galactic and quasar nuclei
[AD-739196] N72-27901
INFRASONIC FREQUENCIES
Microphone detection of infrasound during magnetic storms caused by supersonic motion of auroral electrojets
[KGO-727] N72-27384
INITIATORS [EXPLOSIVES]
Nondestructive test techniques for quality control of electroexplosive devices used for spacecraft equipment actuators
[NASA-CR-127255] N72-27964

INLET FLOW
Interference problems of airframe engine integration in aircraft design optimization
[AGARD-LS-53] N72-27016
Wind tunnel models for determining inlet interference and performance of inlet/airframe combination in supersonic aircraft design
N72-27019

INLET PRESSURE
Inlet random pressure fluctuation effects on turbojet engine stall characteristics
N72-27022

INNER RADIATION BELT
Electron spectra in inner radiation belt observed by Cosmos 219 satellite
[NASA-TT-F-14405] N72-27355
Electron precipitation in inner radiation belt in geomagnetic field deformation
[ESRO-SN-117] N72-27382

INSECTICIDES
Response of Fraunhofer line discriminator to pesticide granules
[NASA-CR-127528] N72-27351

INSTRUMENT APPROACH
Pilot steering error in simulated instrument flight approach to terminal area
[AD-739309] N72-27085

INSTRUMENT LANDING SYSTEMS
Performance tests of instrument landing system localizer to include system and monitor stability and monitor operation under degraded system performance
[FAA-RD-72-50] N72-27694

INSULATION
Inductance device with vacuum insulation and materials of low gas entrapping capability
[NASA-CASE-LEW-10330-1] N72-27226
Behavior of nuclear power plant pressure vessel insulations in helium
[NLL-WH-TRANS-321-[9091.9F]]
N72-27716
Nuclear radiation effects on Saturn 5 materials and design of reusable nuclear shuttle
[NASA-CR-2045] N72-27717

INTEGRATED CIRCUITS
Microelectronic integrated circuits for control of Canopus tracker
[NASA-CR-127418] N72-27251
Integrated circuits and semiconductors for data processing systems
[AD-739548] N72-27258
Feasibility of prediction models for estimating reliability of large scale integration microcircuits
[NASA-CR-123714] N72-27515
Analysis of rebalance loop in strapdown inertial platform to show pulse shape, dc bias, and sampling process
N72-27675

INTEGRATORS
Onboard supervidicon-fiber optical assembly of image converter/integrator vidicon for UV stellar radiation
N72-27445

INTELLIGIBILITY
Binaurally time delayed signal generator for improved speech intelligibility
[AD-738628] N72-27192

INTELSAT SATELLITES
Launch plans and mission objectives for Intelsat 4
[NASA-TM-X-68518] N72-27921

INTERFERENCE DRAG
Aerodynamic interference between wing and surface of velocity discontinuity in nonuniform potential flow field
[NAL-TR-254] N72-27000
Interference problems of airframe engine integration in aircraft design optimization
[AGARD-LS-53] N72-27016
Engine airplane interference corrections in calculating model aircraft performance from wind tunnel test data
N72-27017
Integration of forebody and forebody/wing flow fields into airplane design criteria
N72-27018
Wind tunnel models for determining inlet interference and performance of inlet/airframe combination in supersonic aircraft design
N72-27019
Wind tunnel test results of exhaust nozzle/airframe interference drag for optimization of subsonic aircraft design
N72-27020
Wind tunnel test requirements for simulating nozzle parameters and nozzle airframe interference characteristics
N72-27021
Determination of thrust and drag characteristics for integrated aircraft engine design optimization
N72-27023

INTERFERENCE LIFT
Aerodynamic interference between wing and surface of velocity discontinuity in nonuniform potential flow field
[NAL-TR-254] N72-27000

INTERFEROMETERS
Specifications for onboard ultraviolet thin metallic film mirrors, filters, and interferometers for aerospace environments
N72-27446

INTERMETALLICS
Conversions in Pt-Fe system, and proof of super lattices Fe3Pt and FePt3
[NASA-TT-F-14320] N72-27576

INTERNAL FRICTION
Hydrogen-dislocation interactions in alpha titanium aluminum alloys studied via internal friction measurements at high temperatures
[AD-739696] N72-27593

INTERNATIONAL COOPERATION
Agreement between US and USSR for cooperative space missions and compatibility of spacecraft components
N72-27972

INTERNATIONAL SYSTEM OF UNITS
Standard and scales of international system of units
[NBS-SP-330] N72-27525

INTERPLANETARY MAGNETIC FIELDS
Correlations between azimuthal direction of interplanetary magnetic field and polar cap electric field distributions
[NASA-TM-X-65934] N72-27365
Variations in interplanetary magnetic field polarity and solar magnetic cycle
[NASA-CR-127422] N72-27370

INTERPLANETARY MEDIUM
Quiet time component of interplanetary electrons in energy range 18 keV to 1.8 MeV
[NASA-TM-X-65935] N72-27889
Satellite and ground observations of solar phenomena, meteorology, and interplanetary matter
N72-27893

INTERPLANETARY SPACE
Solar flare protons and physical processes affecting particle propagation in interplanetary space
N72-27829
Solar proton intensity vs time and angular distribution of intensity in interplanetary space near earth
[NASA-CR-127425] N72-27835

INTERPLANETARY SPACECRAFT
Use of electrostatic ion propulsion with nuclear power generation for interplanetary spacecraft and comparison to chemical and nuclear propulsion
[DLR-FB-72-18] N72-27826

INTERPOLATION
Tables of interpolation constants for calculation of transmittance and rate of dissociation of molecular oxygen in mesosphere and lower thermosphere
[NASA-TM-X-58084] N72-27349

INTERSTELLAR GAS
Gas proportional counter for solar wind ions, H and He ions of interstellar origin, and faint optical emission lines for interstellar gas
[NASA-CR-127274] N72-27831

INTERSTELLAR MATTER
Gas proportional counter for solar wind ions, H and He ions of interstellar origin, and faint optical emission lines for interstellar gas
[NASA-CR-127274] N72-27831

INVERSIONS
Inversion, atom-atom collisions and velocity, and undulations
[NASA-CR-127258] N72-27755

INVISCID FLOW
Numerical analysis of inviscid gas flow due to accelerating cylinder and computation of steady subsonic flow
N72-27302
Extension of time dependent technique for inviscid blunt body flow to viscous flow
N72-27303
Computation of transonic inviscid flow with imbedded shock waves
N72-27306

ION BEAMS
Reduction of accelerator grid erosion due to direct impingement of ion beam
[NASA-TM-X-68096] N72-27824

ION CYCLOTRON RADIATION
Ion cyclotron instability and upper flux limits for protons in Jupiter magnetosphere
N72-27870

ION DENSITY [CONCENTRATION]
Ground based Portugal observations of luminous magnetospheric phenomena caused by barium ion release
[AERONOMICA-ACTA-A-102] N72-27372
Concentrations of small ions in air in open country, polluted site, fog, and enclosed room with artifical air conditioning
[NASA-TT-F-14408] N72-27642
Precursor electron and ion densities ahead of ionizing shock waves
[CP-31] N72-27775

ION ENGINES
Design and performance tests of 5-cm diameter ion thruster
[NASA-TM-X-68110] N72-27825

ION PRODUCTION RATES
Calorimeter standard for determining energy of ion pair formation in air
[NLL-M-22434-[5828.4F]] N72-27417

ION PROPULSION
Use of electrostatic ion propulsion with nuclear power generation for interplanetary spacecraft and comparison to chemical and nuclear propulsion
[DLR-FB-72-18] N72-27826

ION SOURCES
Efficiency of ion source for mass spectrometers
[NASA-TT-F-14326] N72-27759

IONIC WAVES
Ion acoustic solitary waves and shocks in two-component argon plasma
[NASA-CR-127387] N72-27770
Frequency and growth rate of ion acoustic instability associated with relative streaming of electrons and ions across weak magnetic fields
[NASA-CR-127272] N72-27771

IONIZATION
Injection of fast molecular ions into trap
[NASA-TT-F-14339] N72-27750
Electron densities in ionization relaxation zone behind shock waves in argon
[CP-32] N72-27774

IONIZED GASES
X ray lines from multicharged ions of iron from hot laser
[AD-739255] N72-27160
Electron energy along stagnation point streamline ahead of blunt body in nonequilibrium, partially ionized gas at supersonic speed
[CP-35] N72-27319
Frequency and growth rate of ion acoustic instability associated with relative streaming of electrons and ions across weak magnetic fields
[NASA-CR-127272] N72-27771

IONOSPHERE
Photoelectron effects in polar ion-exosphere and kinetic wind model
[A-N99-1972] N72-27371
Motion of artificial ionized and luminous clouds in upper ionosphere
N72-27377
Electric coupling between magnetosphere and ionosphere noting time dependent fields, substorms, auroral arcs and double layers
[TRITA-EPP-72-11] N72-27385

IONOSPHERIC DISTURBANCES
VHF correlation radio interferometer consisting of two superheterodyne receivers for investigating ionospheric disturbances by receiving signals from ATS satellites
[NASA-CR-127270] N72-27345
Multisensor arrays for long period acoustic gravity waves in atmosphere
[AD-739260] N72-27387

IONOSPHERIC ELECTRON DENSITY
Maps of predicted electron fluxes for ITOS-A/NOAA-1 circular orbit, 79 deg inclination, and 1463 km altitude
[NASA-TM-X-65917] N72-27357
Ionospheric electron content vs local time data from Faraday rotation observations at Urbana, Illinois from 1 Dec. 1967 to 30 Dec. 1970
[NASA-CR-127524] N72-27369
Horizontal gradients in ionospheric electron density and variations in Doppler frequency for satellite orbits
N72-27379

IONOSPHERIC PROPAGATION
Calculated phase and amplitude from VLF-LF ionospheric channels
[AD-739686] N72-27202
Ionospheric propagation data for E and F regions, India - Sept. 1970
[RTRC-A184] N72-27373
Ionospheric propagation data for E and F regions, India - Aug. 1970
[RTRC-A183] N72-27374
Ionospheric and solar radiation data, Greece - Aug. 1971
N72-27836
Ionospheric propagation and solar radiation data, Greece - July 1971
N72-27837

IONOSPHERIC SOUNDING
Ionospheric sounding data for 1971 from Monte Capellino Observatory, Italy
N72-27380

IONS
Gas proportional counter for solar wind ions, H and He ions of interstellar origin, and faint optical emission lines for interstellar gas
[NASA-CR-127274] N72-27831

IRON
X ray lines from multicharged ions of iron from hot laser
[AD-739255] N72-27160
Discontinuous deformation as function of strain rate and temperature in spherulitic graphite iron
[NLL-TRANS-746-1167-[9022.401]]
N72-27562

Fe-group abundance in energetic solar particles measured by Nike-Apache payloads on 24 Jan. and 2 Sept. 1971 and 2 Sept. 1966
[NASA-TM-X-65919] N72-27833
Solar abundance of iron and damping constant
N72-27843

IRON ALLOYS
Application of continuous cooling transformation diagrams for determining properties of various metals following exposure to welding procedures
[NLL-LTI-746-1053-[9022.401]]
N72-27514
Conversions in Pt-Fe system, and proof of super lattices Fe3Pt and FePt3
[NASA-TT-F-14320] N72-27576
Increase in wear resistance of chrome-nickel cast iron by alloying with niobium
[AD-739285] N72-27583
Role of carbide morphology on low cycle fatigue behavior of iron-carbon alloys
[AD-739508] N72-27592
Irradiation effects on reactor structural materials, including stainless steels and iron alloys
[AD-739312] N72-27726
Stress-relaxation tests of ferritic iron samples to determine plastic deformation processes occurring in stressed material due to thermal energy
[NLL-TRANS-746-1168-[9022.401]]
N72-27942

IRON COMPOUNDS
Dissolution behavior of metallic oxides and iron base compounds in aqueous solutions
[AD-739395] N72-27590

IRREVERSIBLE PROCESSES
Magnetostrictive coefficients of thin nickel films and irreversible resistivity transformations
[NLL-LTI-746-1160-[9022.401]]
N72-27785

ITALY
Ionospheric sounding data for 1971 from Monte Capellino Observatory, Italy
N72-27380
Italian atmospheric pollution determined from total beta activity of dust samples collected from 28 ground stations
N72-27653

ITERATION
Iterative method for synthesis of linear time-varying feedback system with parameter ignorance
[NASA-CR-116777] N72-27252

ITOS 1
Maps of predicted electron fluxes for ITOS-A/NOAA-1 circular orbit, 79 deg inclination, and 1463 km altitude
[NASA-TM-X-65917] N72-27357

J

JET AIRCRAFT
Statistical analysis of flight time, takeoff and landing weight, fuel weight at takeoff and landing for transport jet aircraft
[TB-88] N72-27035

JET AIRCRAFT NOISE
Jet aircraft noise measurements during level flights, using 727, KC-135, 707-320B, and DC-9
[AD-739870] N72-27050

JET FLAPS
Analysis of peak axial-velocity decay in moving airstream for several nozzles and effect on noise generated by short takeoff aircraft with externally blown flaps
[NASA-TM-X-68102] N72-27029
Influence of jet mixing with ambient air on flow around airfoil with jet flap
[AD-739205] N72-27329

JET FLOW
Jet effects on boattail drag of nozzles with truncated conical bodies at supersonic speed and varying ratios of boattail length to maximum diameter
[NASA-TN-D-6789] N72-26997
Bibliography of technical reports on jet impingement, flow, and diffusion
[CE-BIBL-224] N72-27321
Hot-wire anemometer measurement of jet fluctuations in mass flow in gun tunnel
[TT-7205-REV] N72-27419

JET IMPINGEMENT
Bibliography of technical reports on jet impingement, flow, and diffusion
[CE-BIBL-224] N72-27321

JET MIXING FLOW
Wind tunnel tests to determine effect of three dimensional sonic jets to promote boundary layer transition on sharp leading edge flat plate at hypersonic speed
[NASA-TN-D-6802] N72-27312
Influence of jet mixing with ambient air on flow around airfoil with jet flap
[AD-739205] N72-27329

JOSEPHSON JUNCTIONS
Josephson junction amplifier performance
[AD-739383] N72-27243

JOULE-THOMSON EFFECT
Establishment of Joule-Thomson inversion curves for various gases using equations of state
[NASA-TN-D-6807] N72-27965

JOURNAL BEARINGS
Testing cast iron-hardened steel friction pairs
[AD-739278] N72-27534
Friction coefficent determination for plastic steel slide bearings
[AD-739212] N72-27538
Wear analysis on graphite bearings operating in lubrication containing nitric acid
[AD-738746] N72-27539

JUPITER (PLANET)
Part specification solar cells, silicon N-ON-P solderless low temperature operation for Jupiter missions
[NASA-CR-114476] N72-27066
Jupiter decametric radiation data on burst sources, frequency drift rates, Io influence, magnetic field strength, and plasmapause location
N72-27860
Jupiter decimetric data on brightness contour maps, emission centroid position, circular polarization and magnetic field strength, and Faraday rotation and thermal electron density
N72-27861
Proton diffusion data for 5 satellites nearest Jupiter
N72-27864
Summary of studies conducted to determine requirements for nonsurvivable space probe to explore atmosphere of planet Jupiter - Vol. 1
[NASA-CR-122436] N72-27933
Supporting technical studies for design of nonsurvivable probe to explore atmosphere of planet Jupiter - Vol. 2
[NASA-CR-122439] N72-27934

JUPITER ATMOSPHERE
Jupiter radiation belt models, radiation effects, earth-based observations of Jupiter magnetosphere, and Pioneer F and G missions - conference
[NASA-CR-127124] N72-27850
Model for electron and proton energy and density in Jupiter radiation belt
N72-27851
Calculated electron and proton dose rates in Jupiter radiation belts
N72-27852
Equatorial electron energy, number density, and radiative half life in Jupiter magnetosphere, based on synchrotron model with Maxwellian energy distribution
N72-27853
Estimates of energetic electron and proton fluxes in Jupiter radiation belts, dose rates for shielding, and radiation lifetimes of electronic circuits
N72-27854
Specific and monograph models of energetic electrons and protons in Jupiter magnetosphere
N72-27855
Design fluences for electrons and protons and damage effects from low energy electrons and protons for spacecraft in Jupiter radiation belts
N72-27856
Uncertainties in electron and proton flux models and resulting uncertainties in fluences for Jupiter flyby missions
N72-27857
Radiation effects of electrons and protons trapped in Jupiter radiation belts on scientific instruments and electronic components
N72-27858
Jupiter radiation environmental impact on TOPS 12L design
N72-27859
Free-free emission and magnetospheric electron density of Jupiter
N72-27862
Electron and proton energies, densities, and fluxes from 1 to 6 Jupiter radii
N72-27863
Location, density, and energy of energetic protons in Jupiter radiation belts
N72-27865
Proton fluxes in Jupiter magnetosphere from cosmic ray albedo neutron decay
N72-27866
Pitch-angle diffusion and stably trapped limits for protons in Earth and Jupiter magnetospheres
N72-27867
Upper limits of electron and proton fluxes in Jupiter radiation belts, using radial diffusion for getting solar wind fluxes into inner regions of belts
N72-27868
Systematic procedure for identifying spatial regimes of various modes of radio wave propagation in Jupiter magnetosphere to be ecountered by flyby missions
N72-27869
Ion cyclotron instability and upper flux limits for protons in Jupiter magnetosphere
N72-27870
Geiger-Mueller tube epxeriment package for Pioneers F and G to study energetic electrons and protons in Jupiter magnetosphere
N72-27871
Pioneers F and G experiments of gating energetic charged particle detectors, plasma analyzer, and magnetometer for assessing Jupiter radiation belts
N72-27872
Best estimate and upper limit models for Jupiter electron and proton trapped radiation belt
N72-27873
Proposed and alternative models of Jupiter radiation belts
N72-27874
Models for charged particle populations of Jupiter trapped radiation belts
N72-27875
Summary of studies conducted to determine requirements for nonsurvivable space probe to explore atmosphere of planet Jupiter - Vol. 1
[NASA-CR-122436] N72-27933
Supporting technical studies for design of nonsurvivable probe to explore atmosphere of planet Jupiter - Vol. 2
[NASA-CR-122439] N72-27934

JUPITER PROBES
Summary of studies conducted to determine requirements for nonsurvivable space probe to explore atmosphere of planet Jupiter - Vol. 1
[NASA-CR-122436] N72-27933
Supporting technical studies for design of nonsurvivable probe to explore atmosphere of planet Jupiter - Vol. 2
[NASA-CR-122439] N72-27934

K

KALMAN-SCHMIDT FILTERING
Electronically controlled radar tracking with Kalman filtering
[REPT-173] N72-27184
Development and application of Kalman filter techniques to guidance and control of tactical missiles
N72-27686
Kalman-Schmidt filters applied to optimal control of air submarine inertial navigation systems
[NASA-CR-127253] N72-27706

KAONS
Two particle distribution functions in pionization region of multiperipheral model
[TUEP-72-17] N72-27762

KINEMATICS
Least squares method for kinematical geodesy
[AD-737799] N72-27402

KINETIC THEORY
Photoelectron effects in polar ion-exosphere and kinetic wind model
[A-N99-1972] N72-27371

KRYPTON
Using kryptonates as passive temperature sensors
[AD-739372] N72-27478

KURILE ISLANDS
Rayleigh wave detection from Kurile Island earthquakes
[AD-739174] N72-27396
Earthquake observations from seismological stations of the south Kurile Island arc
[TT-70-50126] N72-27399

L

LABORATORIES
Analysis of equipment necessary to set up digital fluidics systems laboratory
[AD-739430] N72-27476

LAMINAR BOUNDARY LAYER
Implicit differential method for laminar, incompressible, steady state boundary layer
[NASA-TT-F-14363] N72-27314
Periodic crossflow effects on heat transfer in laminar axisymmetric boundary layer
[TAE-146] N72-27320
Method for calculating lowest suction rate to prevent laminar boundary layer separation of semibonded stream
[AD-739222] N72-27330
Formulas for laminar compressible similar boundary layers with heat transfer, adverse pressure gradient, and constant cross flow
[AD-739864] N72-27335

LAMINAR FLOW
Finite difference solutions to Navier-Stokes equations for laminar supersonic flow over flat plate and compression corner
[NASA-TR-R-385] N72-27311
Electron energy along stagnation point streamline ahead of blunt body in nonequilibrium, partially ionized gas at supersonic speed
[CP-35] N72-27319
Location of laminar-turbulent transition in wake of 22-deg half angle sharp cones at hypersonic speed
[AD-739318] N72-27326

LAMINATES
Development, stress analysis, and manufacturing of horizontal stabilizer for A-4 aircraft using graphite-epoxy laminates in primary structure
[AD-738900] N72-27040

LAND USE
Geology, climatology, land use, and cadastral aspects of Nicaragua
[PB-207385] N72-27401

LANDAU FACTOR
Collisional broadening of Landau levels in polar semiconductor noting high order perturbation effects
N72-27795

LANDING SIMULATION
Pilot steering error in simulated instrument flight approach to terminal area
[AD-739309] N72-27085

LANGUAGE PROGRAMMING
Hybrid computers and digital simulation languages for continuous system dynamics analysis
[NASA-CR-127252] N72-27220

LAPLACE EQUATION
Numerical method for eigenvalue calculation in Laplace tidal equation for semidiurnal and diurnal oscillations
[NLL-M-22323-[5828.4F]] N72-27612

LASER MATERIALS
Properties of crystalline powders of organic compounds used for second harmonic generation of neodymium laser
N72-27551

LASER OUTPUTS
Characteristics of pulsed carbon dioxide laser and methods for producing powerful ultrashort pulse of laser emission
[NLL-DRIC-TRANS-2644-[3623.66]]
N72-27547

Development and characteristics of power supply for carbon dioxide laser
[NASA-CASE-GSC-11222-1] N72-27548

Feasibility of Cerenkov laser to achieve broadly tunable laser action in ultraviolet region and beyond
[AD-739377] N72-27553

LASERS
X ray lines from multicharged ions of iron from hot laser
[AD-739255] N72-27160

LAUNCH VEHICLES
Design of flight control system for launch vehicle models of geostationary satellite
[NAL-TR-264] N72-27932

LAUNCHERS
Development of technique for launching aerodynamic models at hypersonic speed using helium-operated light gas gun facility
[CP-34] N72-27275

LAUNCHING SITES
Environmental impact statement for Wallops Station Virginia
[NASA-TM-X-68547] N72-27265

LEADING EDGES
Wind tunnel tests to determine effect of three dimensional sonic jets to promote boundary layer transition on sharp leading edge flat plate at hypersonic speed
[NASA-TN-D-6802] N72-27312

LEAKAGE
Standard formula for allowable cabin leakage in military aircraft
[AD-739687] N72-27048

Flowmeter and leak detector for gaseous flow detection in space environments
N72-27519

LEAST SQUARES METHOD
Least squares method for analyzing finned missile rolling at large angle of attack
[AD-739685] N72-27245

Least squares method for kinematical geodesy
[AD-737799] N72-27402

LECTURES
Schedule of meetings and lectures for 1973 technical program of Advisory Group for Aerospace Research and Development
[AGARD-BULL-72-2] N72-27976

LEPTONS
Field model for weak and electromagnetic interactions of leptons and hadrons with charge parity violations
[TR-72-084] N72-27768

LEVEL [HORIZONTAL]
Jet aircraft noise measurements during level flights, using 727, KC-135, 707-320B, and DC-9
[AD-739870] N72-27050

Sound ray theory for analyzing effects of horizontal gradients on acoustic wave propagation velocity in channels
N72-27727

LEVELING
Adjustable support device with jacket screw for altering distance between base and supported member
[NASA-CASE-NPO-10721] N72-27484

LIFT AUGMENTATION
Forward speed effect on lift power of two dimensional jet ground effect support
N72-27006

LIGHT [VISIBLE RADIATION]
Coherent visible light, continuously tunable at 4200 to 7300 A, from optical pumping ammonium dihydrogen phosphate
[AD-739384] N72-27747

LIGHT ELEMENTS
Expressions for contributions by first and second order Feynman diagrams in terms of radial integrals for light atoms
[NASA-TT-F-14403] N72-27752

Numerical calculations of contributions by first and second order Feynman diagrams for light atoms
[NASA-TT-F-14402] N72-27753

Geochemical mapping of lunar surface by Apollo 16 spacecraft for Al, Mg, and Si
[NASA-TM-X-65918] N72-27880

LIGHT GAS GUNS
Development of technique for launching aerodynamic models at hypersonic speed using helium-operated light gas gun facility
[CP-34] N72-27275

LIGHT SOURCES
Electro-optical stabilization of calibrated light source
[NASA-CASE-MSC-12293-1] N72-27411

LIGHT TRANSMISSION
Thin absorbing metallic film for increased visible light transmission
[NASA-CASE-LAR-10836-1] N72-27784

LIGHTING EQUIPMENT
Pressurized inert gas feed for lighting system
[NASA-CASE-KSC-10644] N72-27227

LIGHTNING
Research in deep sea diving and lightning triggered by man
N72-27099

Lightning triggered by man and lightning hazards
N72-27101

System for locating lightning strokes by coordination of directional antenna signals
[NASA-CASE-KSC-10729-1] N72-27234

LIMITS [MATHEMATICS]
Upper bounds for constant weight error correcting codes
[R-916-1-NSF] N72-27621

LINEAR FILTERS
Generalized linear filtering for averaging seismic transfer functions
[AD-739178] N72-27393

LINEAR PREDICTION
Alpha-beta method of linear prediction by radar tracking of flying target, taking into account maximum acceleration
[REPT-154] N72-27182

LINEAR SYSTEMS
Iterative method for synthesis of linear time-varying feedback system with parameter ignorance
[NASA-CR-116777] N72-27252

Smooth empirical Bayes estimator for random scale components of observation error variances for discrete time linear system
[NASA-CR-127527] N72-27620

Numerical analysis of adjoint equations yielding error sensitivities in linear systems applied to guidance and control of tactical missiles
N72-27684

LINKS
Review of microwave communication links
[AD-738694] N72-27191

LIQUID BREATHING
Comparing effects of positive Gy acceleration on cardiovascular and respiratory functions in dogs under normal respiration in air, and when totally immersed in oxygenated fluorocarbon
[NASA-CR-127262] N72-27078

LIQUID COOLING
Steady state and transient temperature distributions in human thigh covered with cooling pad
[NASA-CR-127523] N72-27084

Performance of liquid cooled garment system inside pressure suit of pilot
N72-27121

Water cooled pressure suit with regional body cooling for metabolic heat removal
N72-27124

Automatic controller of liquid cooled space suit using human sweat rate as input signal
N72-27125

Neck cooling collar for improved thermal comfort in hot weather
N72-27126

LIQUID HYDROGEN
Tables on properties of liquid hydrogen at low temperature
[TT-70-50179] N72-27745

LIQUID LASERS
Construction of liquid laser system to produce high energy pulses
[AD-739715] N72-27554

LIQUID METALS
Cryogenic and liquid metal technology applications in industry and for ground transportation
[NASA-TM-X-68092] N72-27737

Temperature dependence of speed of sound and crystal structure of molten metals
[NLL-M-21371-[5828.4F]] N72-27788

LIQUID PHASES
Liquid environment effect on ceramics fracture toughness noting plastic flow induction
[WB-5/71] N72-27956

LIQUID-SOLID INTERFACES
Formation and breakdown of water film moving over solid surfaces
[NASA-TM-X-68071] N72-27291

Stacking fault effects on bounded ultrasonic surface waves in liquid-solid interface
[AD-739703] N72-27748

LIQUIDS
Pressurized tank for feeding liquid waste into processing equipment
[NASA-CASE-LAR-10365-1] N72-27102

Effect of vapor and liquids on friction and wear of molybdenum disulfide
[NLL-RISLEY-TR-2363-[9091.9F]]
N72-27146

Correlation of abrasion, microindentation hardness and maximum fracture velocity of optical glasses in liquids
[WB-2/71] N72-27603

LITHIUM
Lithium organic electrolyte single cells with fluorographite cathodes
[AD-739488] N72-27071

LITHOSPHERE
Multispectral photographic technique proposed for Earth Resources Program to study lithosphere, hydrosphere, and biosphere
N72-27386

LOADS [FORCES]
Analysis of arm performance subjected to external load during crank turning task
[AD-739478] N72-27096

Analysis of stress intensity factor of half-plane crack extending non-uniformly in isotopic elastic solid subjected to general loading
[AD-739557] N72-27957

LOCATES SYSTEM
System for locating lightning strokes by coordination of directional antenna signals
[NASA-CASE-KSC-10729-1] N72-27234

LONG RANGE WEATHER FORECASTING
Relation between stratospheric circulation and pressure distributions at summer-autumn transition and following winter severity for Kyushv district
[NLL-M-22196-[5828.4F]] N72-27637

LONG TERM EFFECTS
Viability of staphylococci isolated from humans subjected to long term isolation in pressurized cabins
[NLL-RTS-7117] N72-27074

LOOPS
Filter for third order phase locked loops used in signal receivers
[NASA-CASE-NPO-11941-1] N72-27249

High speed electrically actuated ribbon loop for shuttering optical or fluid passageways
[NASA-CASE-ARC-10516-1] N72-27739

LOW FREQUENCIES
Calculated phase and amplitude from VLF-LF ionospheric channels
[AD-739686] N72-27202

LOW PASS FILTERS
Theoretical and experimental analysis of mode filters for single frequency Nd YAG lasers anc wideband electro-optic modulators
[AD-738489] N72-27552

LOW TEMPERATURE
Silicon solar cells for low solar intensity and low temperature applications, including manufacturing procedure
[NASA-CR-114475] N72-27065

Tables on properties of liquid hydrogen at low temperature
[TT-70-50179] N72-27745

Low temperature plasma transfer, including vapor diffusion of alkali metals
[AD-738739] N72-27781

LOW TEMPERATURE TESTS
Magnetic phase transitions in presence of external magnetic fields and effect of low temperature on transitions of antiferromagnetic materials
[AD-739259] N72-27800

Optical, thermal, and magnetic properties of group 2-6 compounds and related semiconductors over wide temperature range including very low temperatures
[AD-739867] N72-27810

LUBRICANTS
Auger spectroscopy for detecting polytetrafluoroethylene adhesion on metal surfaces in ultrahigh vacuum
[NASA-TM-X-68076] N72-27150

Testing cast iron-hardened steel friction pairs
[AD-739278] N72-27534

Wear analysis on graphite bearings operating in lubrication containing nitric acid
[AD-738746] N72-27539

Thermal and oxidative stability test methods for fire resistant phosphate ester lubricants of gas turbines
[AD-738477] N72-27543

Analysis of elastohydrodynamic properties of advanced engine lubricants with determination of traction coefficients and film thickness
[AD-739390] N72-27546

Discussion of aircraft fuels and lubricants to include production, analysis, testing and fire safety
[AGARD-AR-44] N72-27811

LUBRICATION
Computer programs to predict friction torque and service life of series-hybrid bearing assembly
[NASA-TM-X-68093] N72-27528

LUMINANCE
Quantitative values of luminance and radiance from high density nanosecond spark channels
[AD-739253] N72-27741

LUMINOSITY
Computation of aberrations of concave grating and optimization of resolution by masking grating parts
N72-27450

LUMINOUS INTENSITY
Intensity control of condenser discharge light [flashers] for runway alignment indicator system
[FAA-RD-72-54] N72-27700

LUNAR ENVIRONMENT
Performance of Apollo portable life support system on lunar mission
N72-27110

LUNAR EVOLUTION
Origin of moon based on Apollo lunar samples
[NASA-TM-X-65924] N72-27886

LUNAR GEOLOGY
Program summary for development of moderate depth lunar drill
[NASA-CR-123724] N72-27526

LUNAR MAPS
Geochemical mapping of lunar surface by Apollo 16 spacecraft for Al, Mg, and Si
[NASA-TM-X-65918] N72-27880

LUNAR RADIATION
Distribution of linearly polarized lunar thermal emission at wavelength of 3.1 mm
[NASA-CR-127273] N72-27848

LUNAR ROCKS
Origin of moon based on Apollo lunar samples
[NASA-TM-X-65924] N72-27886

LUNAR ROVING VEHICLES
Magnetic field tests of Apollo 16 LRV
[NASA-TM-X-65927] N72-27274

LUNAR TOPOGRAPHY
Lunokhod 1 on Sea of Rains
[AD-738681] N72-27939

LUNOKHOD LUNAR ROVING VEHICLES
Design of Lunokhod-1, including two television systems
[AD-738683] N72-27938
Lunokhod 1 on Sea of Rains
[AD-738681] N72-27939

LYMAN ALPHA RADIATION
Cross sections for emission of Lyman alpha radiation in collisions of 1-25 keV protons and hydrogen atoms with constituents of planetary atmospheres
[AD-739184] N72-27395
Holographic gratings for Lyman alpha radiation
N72-27448
Monochromator excited by ultrahigh frequency electrodeless discharge for Lyman alpha calibrating
N72-27463
Onboard monochromator for calibration of near and mean ultraviolet, using single crystal fluorescence
N72-27464

LYMAN BETA RADIATION
Specifications for holographic gratings for spectrophotometer onboard French D2A polar satellite for Lyman beta studies
N72-27449

M

MAGNET COILS
Indirect heat conduction cooling of superconducting Ni-Ti stabilized magnet coils
[DESY-71/57] N72-27794

MAGNETIC DISPERSION
Effect of gyromotor magnetic dispersion field on accuracy of fluid floated gyroscopic instruments
N72-27699

MAGNETIC DOMAINS
Ground based reception of Cosmos-381 satellite signals from magnetically conjugate domain
N72-27180

MAGNETIC FIELDS
Bibliography on magnetometers and techniques for measuring earth's magnetic field
[M70-43/8] N72-27415
Hysteresis losses of magnetic materials in rotating magnetic fields due to Bloch walls
[NLL-CE-TRANS-5686-[9022.09]]
N72-27729
Method for determining magnetic moment of spacecraft from magnetic field data obtained in limited region close to spacecraft
[NASA-TN-D-6685] N72-27732
Plasma generation in free air, explosive electron emission, and superstrong pulsed magnetic fields
[AD-739324] N72-27779
Gas discharges in crossed nonuniform electric and transverse magnetic fields
[AD-739290] N72-27780
Collisional broadening of Landau levels in polar semiconductor noting high order perturbation effects
N72-27795
Low field transport properties of polar semiconductors in parallel strong magnetic and weak electric fields, and computation of distribution functions
N72-27796
Low field transport properties of polar semiconductors in parallel magnetic and electric fields, noting distribution functions
N72-27797
Magnetic phase transitions in presence of external magnetic fields and effect of low temperature on transitions of antiferromagnetic materials
[AD-739259] N72-27800

MAGNETIC INDUCTION
Effects of back iron saturation on single sided induction motor performance
[PB-207327] N72-27238
High speed electrically actuated ribbon loop for shuttering optical or fluid passageways
[NASA-CASE-ARC-10516-1] N72-27739

MAGNETIC MATERIALS
Hysteresis losses of magnetic materials in rotating magnetic fields due to Bloch walls
[NLL-CE-TRANS-5686-[9022.09]]
N72-27729

MAGNETIC MEASUREMENT
Magnetic field tests of Apollo 16 LRV
[NASA-TM-X-65927] N72-27274
Computer programming for analysis of Explorer 34 magnetic field data
[NASA-TM-X-63086] N72-27894

MAGNETIC MIRRORS
Electrostatic singularity in magnetic mirror field in collisionless plasma noting shock formation
[TRITA-EPP-72-10] N72-27777

MAGNETIC MOMENTS
Method for determining magnetic moment of spacecraft from magnetic field data obtained in limited region close to spacecraft
[NASA-TN-D-6685] N72-27732
Magnetic phase transitions in presence of external magnetic fields and effect of low temperature on transitions of antiferromagnetic materials
[AD-739259] N72-27800
Magnetic materials with large orbital contributions to magnetic moments
[AD-739188] N72-27804

MAGNETIC PERMEABILITY
Effects of back iron saturation on single sided induction motor performance
[PB-207327] N72-27238

MAGNETIC POLES
Outwardly directed solar magnetic fields and their origin
[NASA-CR-127423] N72-27834

MAGNETIC PROPERTIES
Properties of superconducting materials and bibliography
[NBS-TN-724] N72-27790
Pyromagnetic transition properties of cobalt-sulfur-selenium system
[AD-739336] N72-27798
Magnetic materials with large orbital contributions to magnetic moments
[AD-739188] N72-27804
Optical, thermal, and magnetic properties of group 2-6 compounds and related semiconductors over wide temperature range including very low temperatures
[AD-739867] N72-27810

MAGNETIC STORMS
Explorer 45 plasmapause measurements
[NASA-TM-X-65931] N72-27432

MAGNETIC SURVEYS
Magnetic observation tables for Resolute, Northwest Territories
[M70-43/5] N72-27339
Methods and instruments for mapping distribution and intensity of earth magnetic field
[NASA-TT-F-14407] N72-27354

MAGNETOHYDRODYNAMIC STABILITY
Stability of ring current protons beyond plasmapause for injection spectrum model
[NASA CR-122447] N72-27347
Frequency and growth rate of ion acoustic instability associated with relative streaming of electrons and ions across weak magnetic fields
[NASA-CR-127272] N72-27771
Formation and stability of double layers in plasmas, and occurrence in ionosphere and solar atmosphere
[TRITA-EPP-72-09] N72-27778

MAGNETOHYDRODYNAMICS
Naturally and induced magnetohydrodynamic effects in casting processes
[PB-207429] N72-27544

MAGNETOMETERS
Methods and instruments for mapping distribution and intensity of earth magnetic field
[NASA-TT-F-14407] N72-27354
Bibliography on magnetometers and techniques for measuring earth's magnetic field
[M70-43/8] N72-27415

MAGNETOSPHERE
Convective electric field and magnetospheric plasma observations using Explorer 40 satellite
[NASA-CR-127254] N72-27350
Ground based Portugal observations of luminous magnetospheric phenomena caused by barium ion release
[AERONOMICA-ACTA-A-102] N72-27372
Electric coupling between magnetosphere and ionosphere noting time dependent fields, substorms, auroral arcs and double layers
[TRITA-EPP-72-11] N72-27385
Magnetosheath plasma entry into earth magnetosphere
[NASA-CR-127424] N72-27776
Jupiter radiation belt models, radiation effects, earth-based observations of Jupiter magnetosphere, and Pioneer F and G missions - conference
[NASA-CR-127124] N72-27850
Specific and monograph models of energetic electrons and protons in Jupiter magnetosphere
N72-27855
Proton fluxes in Jupiter magnetosphere from cosmic ray albedo neutron decay
N72-27866
Pitch-angle diffusion and stably trapped limits for protons in Earth and Jupiter magnetospheres
N72-27867
Systematic procedure for identifying spatial regimes of various modes of radio wave propagation in Jupiter magnetosphere to be ecountered by flyby missions
N72-27869
Ion cyclotron instability and upper flux limits for protons in Jupiter magnetosphere
N72-27870
Geiger-Mueller tube epxeriment package for Pioneers F and G to study energetic electrons and protons in Jupiter magnetosphere
N72-27871

MAGNETOSPHERIC ELECTRON DENSITY
Model for electron and proton energy and density in Jupiter radiation belt
N72-27851
Equatorial electron energy, number density, and radiative half life in Jupiter magnetosphere, based on synchrotron model with Maxwellian energy distribution
N72-27853
Free-free emission and magnetospheric electron density of Jupiter
N72-27862

MAGNETOSTRICTION
Magnetostrictive coefficients of thin nickel films and irreversible resistivity transformations
[NLL-LTI-746-1160-[9022.401]]
N72-27785
Magnetostrictive properties of thin nickel films and effect of magnetic state
[NLL-LTI-746-1159-[9022.401]]
N72-27786

MAINTENANCE
Monitoring circuitry design for self repairing computer
[AD-739417] N72-27224
Repair times and maintenance life cycle cost comparison between transistors and tubes
[AD-739476] N72-27239
Comparing visual and auditory displays when used as dynamic tri-level condition displays for electronic checkout
[AD-739475] N72-27477
Development of procedure for repairing fiberglass structures which retains geometry and strength of original structure
[NASA-CASE-LAR-10416-1] N72-27527
Labor costs and techniques for maintenance of thermal protection system for space shuttle applications
[NASA-CR-112034-1] N72-27922

MAN MACHINE SYSTEMS
Importance of advanced information given to pilots considered as element in automatic control system
[REPT-64] N72-27034
Design of command and control systems using decision and information theory
[AD-739708] N72-27201
Interactive man-computer system for measuring cloud motion from ATS pictures
N72-27647
Functional performance analyses on Skylab foot controlled maneuvering unit
[NASA-CR-61386-APP-R] N72-27920

MAN OPERATED PROPULSION SYSTEMS
Functional performance analyses on Skylab foot controlled maneuvering unit
[NASA-CR-61386-APP-R] N72-27920

MANAGEMENT
Transformation of scientists and engineers into managers
[NASA-SP-291] N72-27986

MANAGEMENT PLANNING
Transportation planning for airports and other intercity terminals
[PB-207529] N72-27280

Procedures for determining capacity of air traffic control systems and application to long range planning, management decisions, and system performance evaluation
[AD-738892] N72-27710
Schedule of meetings and lectures for 1973 technical program of Advisory Group for Aerospace Research and Development
[AGARD-BULL-72-2] N72-27976

MANGANESE ALLOYS
Thermal conductivity of chiatura manganese concentrates and their pelletized products in temperature range of 100 to 900 C
[AD-739215] N72-27585

MANGANESE OXIDES
Reduction reactions and electrolytic separation of manganese dioxide in acid solution
[NLL-M-22291-[5828.4F]] N72-27141

MANNED SPACE FLIGHT
Regenerative portable life support system development for extravehicular human activities during advanced space missions
N72-27113
Carbon dioxide- and thermal-control in regenerative life support system for extravehicular human protection during advanced space missions
N72-27114

MANUFACTURING
Construction of mass spectrometer tubes for gas analysis
[NASA-CR-122433] N72-27231

MAPPING
Clustering technique for analyzing remote multispectral sensing data
[NASA-CR-123799] N72-27204
Updating maps of transportation networks by space photography
[NASA-CR-127530] N72-27422

MARINER 5 SPACE PROBE
Mariner 5 and Venera 4, 5, and 6 pressure vs temperature data for Venus
[NASA-TM-X-65929] N72-27888

MARKOV CHAINS
Statistical computation of linking strategies for multiple radar surveillance using Markov chains
[REPT-130] N72-27181
Limit theorems, Markov processes, additive functionals, and potential theory
[AD-739983] N72-27629

MARS [PLANET]
Combined mission planning for flights to Mars and Phobos/Deimos
[NASA-CR-112077-4] N72-27879

MARS PROBES
Feasibility of cost-effective missions to Mars
[NASA-CR-112077-1] N72-27876

MARTENSITE
Wear resistance of chrome vanadium steels and dependence on distribution of alloying elements in martensite and carbides
[AD-739276] N72-27581

MARYLAND
Environmental impact survey of Goddard Space Flight Center, Greenbelt, Maryland
[NASA-TM-X-68549] N72-27263

MASKS
Operational performance of pneumatic seal-type facemask design
N72-27130

MASS DISTRIBUTION
Controlled distribution of electrophoretic samples in flow path through conductive screens
[NASA-CASE-MFS-21395-1] N72-27425

MASS SPECTROMETERS
Construction of mass spectrometer tubes for gas analysis
[NASA-CR-122433] N72-27231
Efficiency of ion source for mass spectrometers
[NASA-TT-F-14326] N72-27759
Gas-surface interactions and ambient neutral particle densities determined from OGO-6 quadrupole mass spectrometer data
[NASA-TM-X-65923] N72-27887

MASS TRANSFER
Viscosity coefficient characterization by mass or heat diffusion coefficients
[NLL-T-1507-[9022.305]] N72-27289
Analog computer methods used to determine convective heat and mass transfer from water surfaces
[PB-207638] N72-27660

MATERIALS HANDLING
Industrial procedures and safety practices involved in commercial production and handling of oxygen
[NLL-CE-TRANS-5849-[9022.09]] N72-27487

MATERIALS RECOVERY
Vacuum extraction of aluminum during interaction with water
[NLL-M-21374-[5828.4F]] N72-27145

MATERIALS TESTS
Metallurgical test facilities for ESRO satellites noting techniques and equipment
[ESRO-TM-153-ESTEC] N72-27276
Stress rupture tests of brazed joints at elevated temperatures with emphasis on effects of oxidation
[NLL-LTI-746-1165-[9022.401]] N72-27941
Stress-relaxation tests of ferritic iron samples to determine plastic deformation processes occurring in stressed material due to thermal energy
[NLL-TRANS-746-1168-[9022.401]] N72-27942
Characteristics of drop-weight tear tests to determine mechanical properties of plates and large tubes
[NLL-T1512/ERS/72-[9022.305]] N72-27943
Analysis of stress and strain concentration factors under static tensile load in elasto-plastic region
[NAL-TR-279] N72-27950

MATHEMATICAL MODELS
Physical models for visual - vestibular interactions in simulating human nystagmic eye movements
[AD-737795] N72-27090
Control system analysis for mathematical modeling of respiratory protective devices
N72-27128
Mathematical model for fluid mechanics
N72-27308
Optimal control strategies for air quality standards and regulatory policy
[PB-207976] N72-27670
Numerical determination of optimal control strategies for air quality standards and regulatory policy with minimum economic impact of implementation
[PB-207975] N72-27671
Mathematical model for multipath analysis from analog magnetic recordings generated during experimental flights
N72-27707
Simple classical mechanical model for reactive scattering of atom and quasi-diatomic molecule using conservation relations
[NASA-CR-127260] N72-27756

MATRICES [MATHEMATICS]
Development of algorithm based on matrix methods for solution of wind tunnel force-balance equations and iterative solution using automatic computer reduction
[NASA-TN-D-6860] N72-27002
Decomposition of random sequence formed by discretization of continuous stationary random process in terms of column vectors of normalized Hadamard matrix
[NASA-TT-F-13897] N72-27616
Tables for root extrema of Wishart matrix
[AD-739518] N72-27626

MATRIX METHODS
Matrix method for analyzing polarization properties of plane waves
[NASA-CR-127271] N72-27167

MECHANICAL DRIVES
Development of criteria for application of composite materials in construction of helicopter synchronizing drive shafts
[AD-739429] N72-27043
Positioning device using mechanical drive [bevel gears] as digital to analog converter
[REPT-57] N72-27532

MECHANICAL PROPERTIES
Design codes which determine quality and overall cost of pressure vessels constructed in carbon and carbon-manganese steel
N72-27492
Data for estimating strength and performance of fillet-welded joints
N72-27501
Quenching after hot deformation for improved mechanical properties of steels
[PB-207425] N72-27545
Effects of cerium additions on ductility, brittle fracture, and strength of low alloy normalized steels
[NLL-T-518-[9022.305]] N72-27565
Microstructure and mechanical and tensile properties of thermomechanically processed titanium alloys
[AD-739365] N72-27589
Strain rate and elevated temperature effects on mechanical properties of Cr-Mo-V steels
[AD-739516] N72-27591
Compressive stress effects on surface hardness of glazes
[NLL-T-1509-[9022.305]] N72-27595
Effect of aluminum carbide formation on mechanical properties of model carbon-aluminum composite
[ARL/MET-87] N72-27601
Impact test of mobile nuclear reactor containment system
[NASA-TM-X-68103] N72-27721

MEDICAL SCIENCE
Research in Hungary, Poland, Romania, and Yugoslavia in fields of physics, space science, and medicine
[JPRS-56289] N72-27733

MEDITERRANEAN SEA
Sea surface temperature distribution for Atlantic Ocean and Mediterranean Sea
[NLL-M-22342-[5828.4F]] N72-27338

MELTING POINTS
Calibration of thermocouples at melting point of platinum by small batch method
[AD-738748] N72-27474

MERCURY [METAL]
Oil diffusion pumps vs mercury pumps, using varied organic driving media
[NASA-TT-F-14276] N72-27530

MERCURY TELLURIDES
Cadmium telluride/mercury telluride photodiodes as onboard infrared detectors, noting hermetic sealing method
N72-27440

MESOSPHERE
Tables of interpolation constants for calculation of transmittance and rate of dissociation of molecular oxygen in mesosphere and lower thermosphere
[NASA-TM-X-58084] N72-27349
Neutral composition measurements of mesosphere and lower thermosphere
[AD-739169] N72-27664

METAL AIR BATTERIES
Engineering evaluation of AA size primary, nonreserve zinc-air batteries for use in portable communications equipment
[AD-739490] N72-27073

METAL BONDING
Thermal deformation effects on bond integrity and causing of failure modes
N72-27521

METAL COATINGS
Development and characteristics of device for applying multiple layers of noble metal to glass substrate for protection of optical surfaces
[NASA-CASE-LAR-10362-1] N72-27486
Measurement of thickness of metallic coating on plastic sheet using two capacitive probes connected in bridge circuit
[NLL-293-[8660.5]] N72-27512
Effect of diamond burnishing on quality of chromium coatings
[AD-739206] N72-27607

METAL CRYSTALS
Production, application, and properties of polycrystalline metal whiskers used with composite materials
[NLL-TRANS-746-1106-[9022.401]] N72-27555

METAL DRAWING
Deep-drawing and stretch forming behavior of steel in shaping large cylindrical cups
[NLL-TRANS-746-1152-[9022.401]] N72-27483

METAL FATIGUE
Code of practice for designing welded structures subjected to fatigue loading
N72-27498
Plasticity and ductility of metals subjected to high pressure
[NLL-NEL-TT-2371-[6075.461]] N72-27564

METAL FILMS
Measurement of thickness of metallic coating on plastic sheet using two capacitive probes connected in bridge circuit
[NLL-293-[8660.5]] N72-27512
Thin absorbing metallic film for increased visible light transmission
[NASA-CASE-LAR-10836-1] N72-27784
Photoemission energy distributions of aluminum oxide and evaporated aluminum films
[AD-739198] N72-27801

METAL MATRIX COMPOSITES
Optical and electron microscopic examination of metallic Nichrome matrix grain growth behavior during annealing
[NLL-TRANS-746-1173-[9022.401]] N72-27563
Thermal stability of aluminum oxide whiskers in silicon-aluminum alloy matrix
[AD-736973] N72-27608

METAL OXIDES
Dissolution behavior of metallic oxides and iron base compounds in aqueous solutions
[AD-739395] N72-27590

METAL PARTICLES
Production of ultrafine beryllium particles by electrolysis
[NASA-CR-127427] N72-27577

METAL PLATES
Characteristics of drop-weight tear tests to determine mechanical properties of plates and large tubes
[NLL-T1512/ERS/72-[9022.305]] N72-27943

METAL POLISHING
Cathode with insulating material for electrolytic brush polishing of metal surfaces
[NLL-T-1514-[9022.305]] N72-27488

METAL STRIPS
High speed electrically actuated ribbon loop for shuttering optical or fluid passageways
[NASA-CASE-ARC-10516-1] N72-27739

METAL SURFACES
Auger spectroscopy for detecting polytetrafluoroethylene adhesion on metal surfaces in ultrahigh vacuum
[NASA-TM-X-68076] N72-27150
METAL WORKING
Naturally and induced magnetohydrodynamic effects in casting processes
[PB-207429] N72-27544
METAL-METAL BONDING
Thermodynamics of electron beam metal welding with dagger fusion
[AD-739289] N72-27533
METAL-WATER REACTIONS
Vacuum extraction of aluminum during interaction with water
[NLL-M-21374-[5828.4F]] N72-27145
METALLOGRAPHY
Metallurgical test facilities for ESRO satellites noting techniques and equipment
[ESRO-TM-153-ESTEC] N72-27276
Application of continuous cooling transformation diagrams for determining properties of various metals following exposure to welding procedures
[NLL-LTI-746-1053-[9022.401]] N72-27514
METALLURGY
Research in economic geology and extractive metallurgy
[REPT-9] N72-27367
METALS
Gas chromatography and chelation for metal trace determinations in water and human body
[AD-739865] N72-27166
Flotation processes for fine and coarse mineral particles
[NLL-RTS-6963] N72-27558
Analysis of metal embrittlement in hydrogen environments
[NASA-TM-X-68088] N72-27574
METEOROLOGICAL CHARTS
Daily height and temperature analysis of constant pressure levels for Northern Hemisphere
[QR-1-PT-1] N72-27633
METEOROLOGICAL INSTRUMENTS
Airborne gamma surveys for determining water equivalent of snow cover
[TT-70-50093] N72-27662
METEOROLOGICAL PARAMETERS
Synoptic analysis of weather conditions over Atlantic Ocean and Europe for period 14 to 17 February 1962 as basis for determining atmospheric energetics
[REPT-127] N72-27636
Computer analysis and numerical weather forecasting
[TT-70-50185] N72-27659
Meteorological satellite coverage, measurement, and application of data in weather forecasting
[AD-739291] N72-27665
Atmospheric models for mesoscale and small scale effects which influence global climate and weather
[AD-739541] N72-27669
METEOROLOGICAL RADAR
Meteorological radar surveillance of atmospheric conditions during artillery tests conducted in Panama
[AD-739485] N72-27666
METEOROLOGICAL SATELLITES
Meteorological satellite coverage, measurement, and application of data in weather forecasting
[AD-739291] N72-27665
METEOROLOGICAL SERVICES
Meteorological observations by network of weather stations in Odenwald area of Germany
[REPT-128] N72-27635
METEOROLOGY
Atmospheric electricity and earth meteorology
[NLL-M-22318-[5828.4F]] N72-27336
ATS pictures for meteorological applications and satellite-borne instruments
[NASA-CR-122437] N72-27646
Satellite and ground observations of solar phenomena, meteorology, and interplanetary matter N72-27893
METEOSAT SATELLITE
Onboard star tracker with coded pointing system for Meteosat attitude control N72-27459
Parametrization of Meteosat radiometer for visible and infared ranges N72-27466
Specifications and performance of mechanical scanning infrared radiometer for earth cloud cover onboard Meteosat N72-27467
Specifications for Meteosat radiometer including telescope, infrared and visible radiation detectors, detector subsystems, and electronic equipment N72-27468
Preprocessing of Meteosat transmitted images, noting satellite rotation and displacement perturbation vs image geometry quality N72-27469
METHOD OF CHARACTERISTICS
Characteristic equations in generalized curvilinear tensor form for solving elastic wave propagation problems
[NASA-CR-127122] N72-27176
METROLOGY
Proceedings of conference on weights and measures conducted by National Bureau of Standards in July 1971
[NBS-SP-358] N72-27975
MEXICO
Gemini and Apollo observations of geologic structure of Baja California
[NASA-CR-127259] N72-27356
Acoustic reflection profiles from ocean bottom east of Yucatan Peninsula
[PB-207595] N72-27390
Subbottom acoustic reflection profiles for Bay of Campeche in Gulf of Mexico
[PB-207594] N72-27391
MICROANALYSIS
Computer technique for data reduction and correction in quantitative electron probe microanalysis
[NBS-TN-719] N72-27209
MICROCHANNELS
Microchannel electron multiplier array for double proximity focusing image tube design N72-27442
High speed compact, and robust microchannel plate photomultiplier for use as onboard radiation detectors N72-27443
MICRODENSITOMETERS
Microdensitometric film reduction, analysis, and display techniques applied to solar surface radiance and stellar spectral data
[AD-739868] N72-27482
MICROELECTRONICS
Precision surface cutter for screen circuit negatives and other microcircuits
[NASA-CASE-XLA-09843] N72-27485
Quality and reliability requirements for hybrid microcircuits in space flight applications N72-27520
MICROHARDNESS
Correlation of abrasion, microindentation hardness and maximum fracture velocity of optical glasses in liquids
[WB-2/71] N72-27603
MICROMINIATURIZATION
Ultraminiature X ray fluorescence spectrometer for determining element composition data
[NASA-CR-127526] N72-27846
MICROORGANISMS
Results of studies on microorganisms with direct bearing on space biology
[NASA-TT-F-14307] N72-27081
MICROPHONES
Microphone detection of infrasound during magnetic storms caused by supersonic motion of auroral electrojets
[KGO-727] N72-27384
MICROSTRUCTURE
Application of continuous cooling transformation diagrams for determining properties of various metals following exposure to welding procedures
[NLL-LTI-746-1053-[9022.401]] N72-27514
Relation between creep rupture strength and electron microstructure of Cr-Mo steels after heat treatment
[NLL-CE-TRANS-5594-[9022.09]] N72-27560
Reaction kinetics and microstructure resulting from interaction of Ni coating and Sn-Pb solder
[NLL-TRANS-746-1155-[9022.401]] N72-27566
Structural diagram for evaluating class and structural state of stainless steels
[NLL-TRANS-746-1176-[9022.401]] N72-27569
Microstructure and mechanical and tensile properties of thermomechanically processed titanium alloys
[AD-739365] N72-27589
MICROWAVE EQUIPMENT
Microwave power amplifier and processing system for superhigh frequency transmission by Communications Technology Satellite
[NASA-TM-X-68106] N72-27177
Cascade coupling of microwave bipolar transistors forming broadband amplifier
[PB-207377] N72-27241
Solid state physics in microwave generation, microwave amplification, and semiconductors
[AD-739549] N72-27257
Application of microwave guidance sensors for tracking and fire control systems used in missile attack on small tactical targets N72-27693
MICROWAVE IMAGERY
Passive microwave data and relative age of sea ice
[NOAA-TM-NESS-37] N72-27362
MICROWAVE INTERFEROMETERS
Microwave interferometers used as radio eye for aircraft navigation and collision avoidance system including comparison of cost with present systems
[REPT-62] N72-27708
MICROWAVE OSCILLATORS
Solid state microwave oscillator and amplifier development
[AD-739543] N72-27259
MICROWAVE TRANSMISSION
Review of microwave communication links
[AD-738694] N72-27191
MIDAIR COLLISIONS
Investigation of midair collision of Boeing 707 commercial aircraft and Cessna 150 near Edison, New Jersey on 9 January, 1971
[NTSB-AAR-72-16] N72-27025
Statistical analysis of military aircraft damaged by midair collisions with birds during 1972
[AD-739464] N72-27041
Development and characteristics of electronic signalling system and data processing equipment for warning system to avoid midair collisions between aircraft
[NASA-CASE-LAR-10717-1] N72-27703
MIGRATION
Origin of saline soils and chemical migration
[TT-70-50169] N72-27400
MILITARY AIRCRAFT
Design and development of spin-recovery parachute systems for military aircraft and compilation of design criteria
[NASA-TN-D-6866] N72-27033
Statistical analysis of military aircraft damaged by midair collisions with birds during 1972
[AD-739464] N72-27041
Analysis of survival following crashes of military aircraft and identification of areas for improvement in structural design
[AD-739370] N72-27044
MILITARY HELICOPTERS
Analysis of flight loads imposed on H-2 helicopter during fleet operations
[AD-738452] N72-27038
MILITARY TECHNOLOGY
Analysis of military requirements and specifications for aircraft performance using F-5 aircraft
[AD-738625] N72-27039
MILLIMETER WAVES
Results of 15.3 GHz observations with ATS-5 satellite
[NASA-CR-122438] N72-27174
MINERAL DEPOSITS
Research in economic geology and extractive metallurgy
[REPT-9] N72-27367
MINERAL OILS
Statistical analysis of frequency distribution in mineral oil pipeline pressure variations
[FB-93] N72-27325
MINERALS
Flotation processes for fine and coarse mineral particles
[NLL-RTS-6963] N72-27558
MINES [EXCAVATIONS]
Effectiveness and limitations of current portable oxygen breathing equipment for mine rescue operations N72-27107
Design of auxiliary survival shelter as portable life support system in mines N72-27115
Satellite monitoring of open pit and strip mining operations
[BM-IC-8530] N72-27348
MIRRORS
Specifications for onboard ultraviolet thin metallic film mirrors, filters, and interferometers for aerospace environments N72-27446
Quality control and limitations of mirror ultrasonic machining N72-27451
Quality control of lightweight cast honeycomb structure mirrors for infrared astronomical telescope detectors N72-27452
Performance characteristics of Kerber plate applied to spherical aberration correction of Schmidt astronomical telescope mirror N72-27453
Technology and performance characteristics of directive diffuser for ultraviolet use N72-27465
MISS DISTANCE
Application of guidance laws to control and guidance of tactical missiles to reduce amount of miss distance N72-27689
MISSILE CONTROL
Compilation of technical reports on missile design, missile guidance, helicopter stability, VTOL aircraft, and wind tunnel design - Vol. 3
[SBN-11-470153-9] N72-26995

Least squares method for analyzing finned missile rolling at large angle of attack
[AD-739685] N72-27245

Techniques for control and guidance of tactical missiles with emphasis on cost, reliability, and performance
[AGARD-LS-52] N72-27681

Application of control system requirements to development of tactical missile weapon systems
N72-27683

Numerical analysis of adjoint equations yielding error sensitivities in linear systems applied to guidance and control of tactical missiles
N72-27684

Optimizing linear system against quadratic cost function and application to guidance and control system for tactical missiles
N72-27685

Development and application of Kalman filter techniques to guidance and control of tactical missiles
N72-27686

Analysis of digital and analog computer techniques for simulation of missile guidance and control and application of hybrid simulation procedures
N72-27687

Characteristics of electro-optical terminal guidance systems, area correlators, and gated trackers used for guidance and control of tactical missiles
N72-27688

Application of guidance laws to control and guidance of tactical missiles to reduce amount of miss distance
N72-27689

Inertial guidance systems components and technology applied to control and guidance of tactical missiles
N72-27690

Inertial guidance techniques for midcourse guidance and terminal guidance systems with application to control and guidance of tactical standoff missiles
N72-27691

Characteristics of command-to-line-of-sight guidance and semi-active homing missile systems applied to guidance and control of tactical missiles
N72-27692

Application of microwave guidance sensors for tracking and fire control systems used in missile attack on small tactical targets
N72-27693

MISSILE DESIGN

Compilation of technical reports on missile design, missile guidance, helicopter stability, VTOL aircraft, and wind tunnel design - Vol. 3
[SBN-11-470153-9] N72-26995

Techniques for control and guidance of tactical missiles with emphasis on cost, reliability, and performance
[AGARD-LS-52] N72-27681

Mission requirements for air to air missile and digital computer program to synthesize requirements into preliminary design
N72-27682

Application of control system requirements to development of tactical missile weapon systems
N72-27683

Numerical analysis of adjoint equations yielding error sensitivities in linear systems applied to guidance and control of tactical missiles
N72-27684

Optimizing linear system against quadratic cost function and application to guidance and control system for tactical missiles
N72-27685

Development and application of Kalman filter techniques to guidance and control of tactical missiles
N72-27686

Analysis of digital and analog computer techniques for simulation of missile guidance and control and application of hybrid simulation procedures
N72-27687

Characteristics of electro-optical terminal guidance systems, area correlators, and gated trackers used for guidance and control of tactical missiles
N72-27688

Application of guidance laws to control and guidance of tactical missiles to reduce amount of miss distance
N72-27689

Inertial guidance systems components and technology applied to control and guidance of tactical missiles
N72-27690

Inertial guidance techniques for midcourse guidance and terminal guidance systems with application to control and guidance of tactical standoff missiles
N72-27691

Characteristics of command-to-line-of-sight guidance and semi-active homing missile systems applied to guidance and control of tactical missiles
N72-27692

MISSILE SIMULATORS

Techniques for control and guidance of tactical missiles with emphasis on cost, reliability, and performance
[AGARD-LS-52] N72-27681

MISSILE TRACKING

Statistical covariance technique for computerized error analysis on missile tracking system
[AD-739513] N72-27223

MISSILES

Missile military personnel management appropriations
[AD-739504] N72-27989

MISSION PLANNING

Development of manual navigation sightings for evaluating performance of Skylab corollary experiments
[NASA-CR-61386-APP-O] N72-27680

Feasibility of cost-effective missions to Mars
[NASA-CR-112077-1] N72-27876

Satellite rendezvous, landing, and roving mission to Phobos and Deimos
[NASA-CR-112077-2] N72-27877

Objectives, payloads, sampling, and return for Phobos/Deimos mission
[NASA-CR-112077-3] N72-27878

Combined mission planning for flights to Mars and Phobos/Deimos
[NASA-CR-112077-4] N72-27879

Mission analysis and preliminary shuttle/payload constraints analysis
[NASA-CR-127118] N72-27914

Launch plans and mission objectives for Intelsat 4
[NASA-TM-X-68518] N72-27921

Agreement between US and USSR for cooperative space missions and compatibility of spacecraft components
N72-27972

MISSISSIPPI

Environmental impact statement for Marshall Space Flight Center Huntsville, Ala, and MTF in Hancock County Mississippi
[NASA-TM-X-68542] N72-27264

MIXING

Convection and mixing of stratified fluid in rotating container for Apollo spacecraft
[NASA-TR-R-386] N72-27313

MODELS

Performance, construction, and applications of sealed nickel cadmium batteries
[AD-739211] N72-27068

MODULATION

Technique for estimating modulation transfer function of imaging system from edge response
[AD-739550] N72-27479

MODULATORS

Theoretical and experimental analysis of mode filters for single frequency Nd YAG lasers and wideband electro-optic modulators
[AD-738489] N72-27552

Bibliography on linear electro-optic modulator materials
[AD-739360] N72-27742

MOIRE EFFECTS

Calculation of fields of partial derivatives in plastic deformations by method of Moire bands
[NLL-M-21376-[5828.4F]] N72-27615

MOISTURE CONTENT

Droplet size and concentration, and liquid water content of altostratus, altocumulus, and middle level accessory clouds
[TN-43] N72-27644

Airborne gamma surveys for determining water equivalent of snow cover
[TT-70-50093] N72-27662

MOLDS

Storage of compounded unvulcanized natural rubber mixes noting methods of examining changes
[ERDE-TR-44-PT-1] N72-27602

MOLECULAR COLLISIONS

Simple classical mechanical model for reactive scattering of atom and quasi-diatomic molecule using conservation relations
[NASA-CR-127260] N72-27756

Optimal means of characterizing product and reactant energy distributions in molecular collisions, information content of internal state distribution, and entropy deficiency
[NASA-CR-127261] N72-27757

MOLECULAR EXCITATION

Transition amplitudes of multiphoton excitations of vibrational rotational states in diatomic molecules in intense electromagnetic fields
[NASA-CR-127419] N72-27761

MOLECULAR FLOW

Monte Carlo method for variance reduction in analysis of rarefied gas diffusion between parallel walls
[NASA-TM-X-68094] N72-27156

MOLECULAR IONS

Injection of fast molecular ions into trap
[NASA-TT-F-14339] N72-27750

MOLECULAR OSCILLATORS

Application of atomic oscillators for direct measurement of effects of gravitation on time to verify equivalence principle
[NASA-CR-127429] N72-27363

MOLECULAR STRUCTURE

Computerized graph techniques based on algorithms with several applications including molecular structures and networks
[REPT-127] N72-27221

MOLYBDENUM ALLOYS

Effect of different niobium contents on microstructure and degree of dispersion hardening of cast Cr-Ni alloys including effect of supplementary Mo alloying
[NLL-TRANS-746-1143-[9022.401]]
N72-27567

Diffusion scattering of X rays by solid U-Mo solution
[AD-739226] N72-27587

MOLYBDENUM DISULFIDES

Effect of vapor and liquids on friction and wear of molybdenum disulfide
[NLL-RISLEY-TR-2363-[9091.9F]]
N72-27146

MONITORS

Optical system for monitoring angular position of rotating mirror
[NASA-CASE-GSC-11353-1] N72-27736

Establishment of criteria for design of onboard monitoring and checkout equipment for use with space shuttle propulsion system - Vol. 1
[NASA-CR-123712] N72-27911

MONKEYS

Vestibular-ocular counterroll reflex for determining vestibular response dynamics of monkeys to acceleration
[AD-737828] N72-27094

MONOCHROMATORS

Monochromator excited by ultrahigh frequency electrodeless discharge for Lyman alpha calibrating
N72-27463

Onboard monochromator for calibration of near and mean ultraviolet, using single crystal fluorescence
N72-27464

MONOPOLES

Monopole theory formulation with gauge dependent fields and potentials
[TR-72-129] N72-27767

MONTE CARLO METHOD

Monte Carlo method for variance reduction in analysis of rarefied gas diffusion between parallel walls
[NASA-TM-X-68094] N72-27156

MOSSBAUER EFFECT

Influence of relaxation processes on Mossbauer measurements of superparamagnetic alpha-FeOOH and alpha-Fe2O3 crystallites
N72-27793

MOTIVATION

Transformation of scientists and engineers into managers
[NASA-SP-291] N72-27986

MULTIPATH TRANSMISSION

Mathematical model for multipath analysis from analog magnetic recordings generated during experimental flights
N72-27707

MULTIPLEXING

Time-axis-compression multiplex transmission and analysis of compression signals and waveforms
[REPT-18] N72-27203

MULTISPECTRAL PHOTOGRAPHY

Clustering technique for analyzing remote multispectral sensing data
[NASA-CR-123799] N72-27204

Multispectral photographic technique proposed for Earth Resources Program to study lithosphere, hydrosphere, and biosphere
N72-27386

MULTIVARIATE STATISTICAL ANALYSIS

Best estimates of multivariate functions based on derivatives
[NLL-M-22320-[5828.4F]] N72-27613

MUSCULAR FUNCTION

Multichannel bioelectric control system for simulating neuromuscular movements and treating motor function disturbances
[NRC-TT-1552] N72-27134

N

NASA PROGRAMS

Program summary for development of moderate depth lunar drill
[NASA-CR-123724] N72-27526

Analysis of structural failures occurring during NASA programs and recommendations to prevent or minimize similar failures in future programs
[NASA-TM-X-68850] N72-27946

Agreement between US and USSR for cooperative space missions and compatibility of spacecraft components
N72-27972

Application of technologies developed by NASA programs for solution of problems in urban communities
[NASA-CR-127417] N72-27985

Procurement research and cost estimates of DOD and NASA
[AD-738983] N72-27987
NATURAL SATELLITES
Proton diffusion data for 5 satellites nearest Jupiter N72-27864
NAVIER-STOKES EQUATION
Three approximation methods for full Navier-Stokes equations for two and three dimensional unsteady flow N72-27296
Nonstationary flow of viscous incompressible fluid in bounded domain N72-27297
Navier-Stokes equations of viscous incompressible fluid in bounded domain N72-27298
Numerical analysis of Navier-Stokes equations for time-dependent, nonlinear fluid flow N72-27299
Finite difference solutions to Navier-Stokes equations for laminar supersonic flow over flat plate and compression corner
[NASA-TR-R-385] N72-27311
Navier-Stokes equations for natural convection in enclosure with localized heating from below
[PB-208111] N72-27334
NAVIGATION AIDS
Kalman-Schmidt filters applied to optimal control of air submarine inertial navigation systems
[NASA-CR-127253] N72-27706
NAVIGATION INSTRUMENTS
Inertial guidance systems components and technology applied to control and guidance of tactical missiles N72-27690
NEBRASKA
Environmental impact survey of hail in Colorado, Wyoming, and Nebraska
[PB-207539-F] N72-27661
NECK [ANATOMY]
Neck cooling collar for improved thermal comfort in hot weather N72-27126
NEODYMIUM COMPOUNDS
Properties of crystalline powders of organic compounds used for second harmonic generation of neodymium laser N72-27551
NETWORK SYNTHESIS
Computer terminal network for transparent stimulation of user of on-line retrieval system
[NBS-TN-732] N72-27217
All-pass networks with Wien bridge and differential amplifier
[NLL-TRANS-2850-[9022.81]] N72-27248
Iterative method for synthesis of linear time-varying feedback system with parameter ignorance
[NASA-CR-116777] N72-27252
Synthesis of feedback systems with large plant ignorance for prescribed time domain tolerances
[NASA-CR-116779] N72-27253
NETWORKS
Computer network and systems software development
[AD-739705] N72-27225
NEUROMUSCULAR TRANSMISSION
Bioelectric system for control of muscular activity
[NRC-TT-1551] N72-27083
Multichannel bioelectric control system for simulating neuromuscular movements and treating motor function disturbances
[NRC-TT-1552] N72-27134
NEUTRAL PARTICLES
Gas-surface interactions and ambient neutral particle densities determined from OGO-6 quadrupole mass spectrometer data
[NASA-TM-X-65923] N72-27887
NEUTRON BEAMS
Applications and operational constraints of conventional X radiographic and neutron imaging techniques N72-27517
NEUTRON COUNTERS
Sensitivity changes in neutron detectors in intense gamma fields
[NLL-WH-TRANS-324-[9091.9F]] N72-27418
NEUTRON DECAY
Proton fluxes in Jupiter magnetosphere from cosmic ray albedo neutron decay N72-27866
NEUTRON SOURCES
Performance of solid and gaseous tritium targets as neutron generators
[NASA-TT-F-14337] N72-27719
NEVADA
Environmental impact statement for Nuclear Rocket Development Station, Nevada
[NASA-TM-X-68555] N72-27268
NEWTON THEORY
Conservation laws and preferred frames in relativistic gravity
[NASA-CR-127277] N72-27358
Preferred-frame theories of gravity and extended parameterized post-Newtonian formalism N72-27359
NICHROME [TRADEMARK]
Optical and electron microscopic examination of metallic Nichrome matrix grain growth behavior during annealing
[NLL-TRANS-746-1173-[9022.401]] N72-27563
Long term stability of Nichrome based heat resistant composite, reinforced with tungsten fibers
[NLL-TRANS-746-1148-[9022.401]] N72-27596
NICKEL
Magnetostricuve coefficients of thin nickel films and irreversible resistivity transformations
[NLL-LTI-746-1160-[9022.401]] N72-27785
Magnetostrictive properties of thin nickel films and effect of magnetic state
[NLL-LTI-746-1159-[9022.401]] N72-27786
NICKEL ALLOYS
Effect of different niobium contents on microstructure and degree of dispersion hardening of cast Cr-Ni alloys including effect of supplementary Mo alloying
[NLL-TRANS-746-1143-[9022.401]] N72-27567
Analysis of conditions producing superplasticity in nickel-chromium eutectic alloy
[NLL-TRANS-746-1185-[9022.401]] N72-27568
Nickel-tin alloy deposition with hydrazine hydrate
[NLL-TRANS-746-1196-[9022.401]] N72-27572
Compositional limits of gamma and gamma prime phases in nickel base superalloys
[NASA-CR-120940] N72-27575
X ray photography used to obtain thermal expansion data for nickel-chromium alloys
[AD-739301] N72-27588
Composite materials of nickel-chromium matrix and molybdenum-tungsten reinforcing fibers
[NLL-TRAS-746-1190-[9022.401]] N72-27597
NICKEL CADMIUM BATTERIES
Nickel cadmium batteries for aerospace application including separators and seals, and cell performance and specification experience - 1971 NASA/Goddard-Aerospace Industry Battery Workshop
[NASA-TM-X-68828] N72-27061
Nickel cadmium batteries for aerospace application including materials, pre-charge, and thermal problems - 1971 NASA/Goddard-Aerospace Industry Battery Workshop
[NASA-TM-X-68829] N72-27062
Performance, construction, and applications of sealed nickel cadmium batteries
[AD-739211] N72-27068
Calorimeter for measuring thermal output of nickel cadmium batteries
[NASA-CASE-GSC-11434-1] N72-27430
NICKEL COATINGS
Reaction kinetics and microstructure resulting from interaction of Ni coating and Sn-Pb solder
[NLL-TRANS-746-1155-[9022.401]] N72-27566
NICKEL COMPOUNDS
Effect of gamma irradiation on first constant of magnetic crystallographic anisotropy of single crystals of nickel and nickel copper ferrites
[AD-739286] N72-27805
NICKEL STEELS
Activity and solubility of carbon in austenitic chromium-nickel steels with approximately 18 percent Cr at temperatures between 950 and 1200 C
[NLL-CE-TRANS-5881-[9022.09]] N72-27561
NIGHT
Relation between amount and depth of radiation inversions at night and diurnal range of air temperature at 2-m height in different USSR regions
[NLL-M-22336-[5828.4F]] N72-27630
NIMBUS SATELLITES
Environmental impact statement of Nimbus satellite program
[NASA-TM-X-68554] N72-27908
NIMBUS 2 SATELLITE
Regression methods in five day mean height prediction at 500 mb using mean Nimbus 2 composited infrared data for identical periods in update procedure
[AD-739358] N72-27656
NIOBIUM ALLOYS
Effect of different niobium contents on microstructure and degree of dispersion hardening of cast Cr-Ni alloys including effect of supplementary Mo alloying
[NLL-TRANS-746-1143-[9022.401]] N72-27567
Increase in wear resistance of chrome-nickel cast iron by alloying with niobium
[AD-739285] N72-27583
NITRIC ACID
Wear analysis on graphite bearings operating in lubrication containing nitric acid
[AD-738746] N72-27539
NITROGEN ATOMS
Nitrogen atom generation by nitrogen gas flow over heated filaments
[AD-739520] N72-27164
NITROGEN COMPOUNDS
Vacuum thermal decomposition of combustion intermediates from reaction of N2O4 with N2H4
[AD-739187] N72-27163
NOBLE METALS
Development and characteristics of device for applying multiple layers of noble metal to glass substrate for protection of optical surfaces
[NASA-CASE-LAR-10362-1] N72-27486
NOISE [SOUND]
Effects of noise and illumination on human motor performance
[AD-739474] N72-27095
Effect of noise and temperature on human performance of simple manual dexterity task
[AD-739432] N72-27097
NOISE INTENSITY
Tests of broadband high intensity noise on human equilibrium
[AD-737826] N72-27093
NOISE REDUCTION
Acoustic measuremer t tests to determine reduction of aerodynamic noise by engine-over-wing concept for conventional and STOL aircraft
[NASA-TM-X-68104] N72-27030
Computerized simulation of radar sidelobe clutter reduction by pulse compression
[AD-739512] N72-27195
Noise reduction and signal to noise ratio for seismic arrays for twenty-four hour events
[AD-739181] N72-27394
NONDESTRUCTIVE TESTS
Nondestructive test techniques for quality control of electroexplosive devices used for spacecraft equipment actuators
[NASA-CR-127255] N72-27964
NONFLAMMABLE MATERIALS
Thermal and oxidative stability test methods for fire resistant phosphate ester lubricants of gas turbines
[AD-738477] N72-27543
NORMAL DENSITY FUNCTIONS
Optimal quantization of chromatographic function based on Gaussian distribution
[NLL-TRANS-836-[9022.64]] N72-27143
Normalized orthogonal exponential functions for approximating differential distribution laws
[NLL-M-22459-[5828.4F]] N72-27614
NORMALIZING [STATISTICS]
Normalized orthogonal exponential functions for approximating differential distribution laws
[NLL-M-22459-[5828.4F]] N72-27614
NORTHERN HEMISPHERE
Daily height and temperature analysis of constant pressure levels for Northern Hemisphere
[QR-1-PT-1] N72-27633
NOSE CONES
Pressure distribution and shear effect on blunt bodies produced by bow shock wave under supersonic speed conditions
[NAL-TR-266] N72-26998
NOZZLE FLOW
Analysis of peak axial-velocity decay in moving airstream for several nozzles and effect on noise generated by short takeoff aircraft with externally blown flaps
[NASA-TM-X-68102] N72-27029
NOZZLE GEOMETRY
Interference problems of airframe engine integration in aircraft design optimization
[AGARD-LS-53] N72-27016
Wind tunnel test results of exhaust nozzle/airframe interference drag for optimization of subsonic aircraft design N72-27020
Wind tunnel test requirements for simulating nozzle parameters and nozzle airframe interference characteristics N72-27021
Axisymmetric nozzle for producing test section flow in hypersonic test facility
[NASA-TM-X-64664] N72-27273
NUCLEAR BINDING ENERGY
Bounded coupling constants in field theory with one space and one time dimension
[TR-73-003] N72-27764
NUCLEAR ELECTRIC POWER GENERATION
Use of electrostatic ion propulsion with nuclear power generation for interplanetary spacecraft and comparison to chemical and nuclear propulsion
[DLR-FB-72-18] N72-27826
NUCLEAR ELECTRIC PROPULSION
Use of electrostatic ion propulsion with nuclear power generation for interplanetary spacecraft and comparison to chemical and nuclear propulsion
[DLR-FB-72-18] N72-27826
NUCLEAR EXPLOSIONS
Human eardrum rupture and hearing loss injuries from nuclear explosions
[AD-737643] N72-27092
Maximum flux vs azimuth as function of time following detonation of source of radiation belt electrons
[AD-739495] N72-27405
NUCLEAR FUEL ELEMENTS
Electric heaters for simulating nuclear fuel elements during heat transfer experiments
[NLL-CE-TRANS-5885-[9022.09]]

N72-27715

NUCLEAR HEAT
Nuclear heating effects on propellant and structures of reusable nuclear shuttle configuration
[NASA-CR-2042] N72-27718

NUCLEAR MODELS
Two particle distribution functions in pionization region of multiperipheral model
[TUEP-72-17] N72-27762
Radial baryon excitation modes in symmetric quark model
[TR-72-088] N72-27766
Solution of nonlinear Lee nuclear field theoretical model in Hilbert space
[NOTA-INTERNA-356] N72-27769

NUCLEAR POTENTIAL
Monopole theory formulation with gauge dependent fields and potentials
[TR-72-129] N72-27767

NUCLEAR POWER PLANTS
Behavior of nuclear power plant pressure vessel insulations in helium
[NLL-WH-TRANS-321-[9091.9F]] N72-27716
Gas core reactor power transient analysis featuring high temperatures
[NASA-TM-X-68089] N72-27723

NUCLEAR REACTOR CONTROL
Impact test of mobile nuclear reactor containment system
[NASA-TM-X-68103] N72-27721

NUCLEAR ROCKET ENGINES
Environmental impact statement for Nuclear Rocket Development Station, Nevada
[NASA-TM-X-68555] N72-27268
Nuclear radiation effects on Saturn 5 materials and design of reusable nuclear shuttle
[NASA-CR-2045] N72-27717

NUCLEATION
X ray and laser irradiation of glycol sulfate crystals in relation to nucleation and spontaneous polarization
[NLL-TRANS-855-[9022.64]] N72-27148

NUCLEONS
Interactions of nucleons bound in heavy nuclei with high energy cosmic rays
[NASA-TT-F-14409] N72-27832

NUMBER THEORY
Structural data coding method using numbered binary sequences
[NASA-TT-F-13895] N72-27172

NUMERICAL ANALYSIS
Numerical analysis of one, two, and three dimensional fluid flow - conferences
[AGARD-LS-48] N72-27293
Mathematical aspects of fluid mechanics and numerical analysis of partial differential equations N72-27294
Numerical approximation of non-Cauchy-Kowaleska systems in hydrodynamics N72-27295
Numerical analysis of Navier-Stokes equations for time-dependent, nonlinear fluid flow N72-27299
Numerical analysis of viscous gas flow and shock formation N72-27300
Computation of one dimensional shocked flow N72-27301
Numerical analysis of inviscid gas flow due to accelerating cylinder and computation of steady subsonic flow N72-27302
Extension of time dependent technique for inviscid blunt body flow to viscous flow N72-27303
Numerical analysis of time dependent gas dynamics and accuracy in regions of continuous flow N72-27304
Computation of transonic inviscid flow with imbedded shock waves N72-27306
Numerical analysis of three dimensional ideal gas flow and Euler equations of motion N72-27307
Numerical method for eigenvalue calculation in Laplace tidal equation for semidiurnal and diurnal oscillations
[NLL-M-22323-[5828.4F]] N72-27612
Analysis principles of strapdown inertial platforms with emphasis on rebalance loop electronics and attitude algorithms N72-27674
Numerical analysis of Hartree-Fock diagrams for ground state energies in perturbation field theory
[NASA-TT-F-14401] N72-27754
Development and numerical analysis of three-dimensional optimal explicit guidance system for space vehicles
[NAL-TR-258] N72-27931

NUMERICAL WEATHER FORECASTING
Computer analysis and numerical weather forecasting
[TT-70-50185] N72-27659

NUTATION DAMPERS
Motion of nutation damper on spin-stabilized axisymmetric spacecraft
[NAL-TR-251] N72-27892

NYSTAGMUS
Physical models for visual - vestibular interactions in simulating human nystagmic eye movements
[AD-737795] N72-27090
Vestibular-ocular counterroll reflex for determining vestibular response dynamics of monkeys to acceleration
[AD-737828] N72-27094

O

OAO 3
Design of stored program computer for OAO 3
[NASA-TM-X-65937] N72-27211

OBLIQUE COORDINATES
Approximations for difference problem with oblique derivitive in half plane
[NASA-TT-F-14346] N72-27617

OCEAN BOTTOM
Ocean bottom acoustic reflection profiles for Greater and Lesser Antilles
[PB-207596] N72-27389
Acoustic reflection profiles from ocean bottom east of Yucatan Peninsula
[PB-207595] N72-27390
Subbottom acoustic reflection from continental shelf off Venezuela
[PB-207597] N72-27392
Ocean surface, ocean bottom, and near shore engineering
[AD-738476] N72-27404

OCEAN SURFACE
Sea surface temperature distribution for Atlantic Ocean and Mediterranean Sea
[NLL-M-22342-[5828.4F]] N72-27338
Statistics and environmental causes of amplitude modulation near ocean surface
[AD-739357] N72-27388
Ocean surface, ocean bottom, and near shore engineering
[AD-738476] N72-27404

OCEANOGRAPHY
Ocean surface, ocean bottom, and near shore engineering
[AD-738476] N72-27404

OGO
Acoustic vibratory response of structural OGO model enclosed in shroud and without shroud
[NASA-TM-X-65921] N72-27735

OGO-D
Functional characteristics of OGO-4 main body airglow photometer utilizing cathode photomultiplier to sense light at selected wavelengths
[NASA-TM-X-65926] N72-27423

OGO-F
Gas-surface interactions and ambient neutral particle densities determined from OGO-6 quadrupole mass spectrometer data
[NASA-TM-X-65923] N72-27887

OHIO
Environmental impact statement for Lewis Research Center Cleveland, Ohio
[NASA-TM-X-68557] N72-27266
Environmental impact surveys of quiet engine program
[NASA-TM-X-68545] N72-27814

OILS
Oil diffusion pumps vs mercury pumps, using varied organic driving media
[NASA-TT-F-14276] N72-27530

OMEGA NAVIGATION SYSTEM
Analysis of very low frequency auroral zone in Alaska to determine effect on accuracy of Omega navigation system in polar regions
[AD-739689] N72-27714

ON-LINE PROGRAMMING
Modifying Siegel-Wolf operator simulation model for on-line operation
[AD-737798] N72-27138

ONBOARD EQUIPMENT
Onboard optical equipment, radiation sources and detectors for aerospace environments - conferences N72-27435
Onboard photomultiplier tubes sensitive to ultraviolet radiation developed for Signe, OSO, and D2B projects N72-27436
Performance and specifications of thermistor bolometers for sensing horizon for attitude control N72-27437
Cadmium telluride/mercury telluride photodiodes as onboard infrared detectors, noting hermetic sealing method N72-27440
High resolution photomultiplier tube for onboard far ultraviolet photometer in aerospace environment N72-27441
High speed compact, and robust microchannel plate photomultiplier for use as onboard radiation detectors N72-27443
Performance limitations of onboard image analyzer, noting photoconductive and photoemissive tubes N72-27444
Onboard supervidicon-fiber optical assembly of image converter/integrator vidicon for UV stellar radiation N72-27445
Specifications for onboard ultraviolet thin metallic film mirrors, filters, and interferometers for aerospace environments N72-27446
Onboard optical system degradation prediction by space environment simulation N72-27456
Specifications of multichannel solar spectrometer onboard OSO-1, noting experimental design N72-27457
Onboard solar sensors for French D2B satellite attitude control N72-27458
Onboard star tracker with coded pointing system for Meteosat attitude control N72-27459
Attitude simulator for performance prediction of infrared horizon scanner for onboard geostationary satellite, noting rotating and static simulation N72-27462
Onboard monochromator for calibration of near and mean ultraviolet, using single crystal fluorescence N72-27464
Parametrization of Meteosat radiometer for visible and infared ranges N72-27466
Specifications for Meteosat radiometer including telescope, infrared and visible radiation detectors, detector subsystems, and electronic equipment N72-27468
Establishment of criteria for design of onboard monitoring and checkout equipment for use with space shuttle propulsion system - Vol. 1
[NASA-CR-123712] N72-27911

ONE DIMENSIONAL FLOW
Computation of one dimensional shocked flow N72-27301

OPERATIONS RESEARCH
Analysis of flight loads imposed on H-2 helicopter during fleet operations
[AD-738452] N72-27038
Factors affecting optimum flight routes for supersonic transport aircraft operation
[NLL-M-22436-[5828.4F]] N72-27672
Environmental impact statement of space shuttle program
[NASA-TM-X-68541] N72-27910

OPERATOR PERFORMANCE
Modifying Siegel-Wolf operator simulation model for on-line operation
[AD-737798] N72-27138

OPERATORS [MATHEMATICS]
Set of general properties for conformal covariant theories
[NOTA-INTERNA-361] N72-27624

OPTICAL CORRECTION PROCEDURE
Performance characteristics of Kerber plate applied to spherical aberration correction of Schmidt astronomical telescope mirror N72-27453
Thin film vacuum deposition for optical surface finishing, noting dihedral deposition on reflector surface N72-27454
Optimization of image resolution by analog technique, compensating for aberration and diffraction defects N72-27470

OPTICAL DATA PROCESSING
Preprocessing of Meteosat transmitted images, noting satellite rotation and displacement perturbation vs image geometry quality N72-27469

OPTICAL EQUIPMENT
Onboard optical equipment, radiation sources and detectors for aerospace environments - conferences N72-27435
Degradation of optical materials in aerospace environments noting point defects induced by ionizing radiation or charged particle collision N72-27455
Onboard optical system degradation prediction by space environment simulation N72-27456
Development and characteristics of device for applying multiple layers of noble metal to glass substrate for protection of optical surfaces
[NASA-CASE-LAR-10362-1] N72-27486
Characteristics of pulsed carbon dioxide laser and methods for producing powerful ultrashort pulse of laser emission
[NLL-DRIC-TRANS-2644-[3623.66]] N72-27547

Optical system for monitoring angular position of rotating mirror
[NASA-CASE-GSC-11353-1] N72-27736
OPTICAL FILTERS
Fluorescence spectra and optical filters
[NASA-CR-127257] N72-27149
OPTICAL PROPERTIES
Design and development of light sensing device for controlling orientation of object relative to sun or other light source
[NASA-CASE-NPO-11201] N72-27409
Property data tables for group 2-6 compounds
[AD-739359] N72-27799
Optical, thermal, and magnetic properties of group 2-6 compounds and related semiconductors over wide temperature range including very low temperatures
[AD-739867] N72-27810
OPTICAL PUMPING
Coherent visible light, continuously tunable at 4200 to 7300 A, from optical pumping ammonium dihydrogen phosphate
[AD-739384] N72-27747
OPTICAL TRACKING
Optical satellite tracking of Cosmos and other artificial satellites, Edinburgh, Feb. 1972
[ROE-STS-123] N72-27936
Optical satellite tracking of Cosmos and other artificial satellites, Edinburgh, Mar. 1972
[ROE-STS-124] N72-27937
OPTIMAL CONTROL
Optimal control strategies for air quality standards and regulatory policy
[PB-207976] N72-27670
Numerical determination of optimal control strategies for air quality standards and regulatory policy with minimum economic impact of implementation
[PB-207975] N72-27671
Kalman-Schmidt filters applied to optimal control of air submarine inertial navigation systems
[NASA-CR-127253] N72-27706
Development and numerical analysis of three-dimensional optimal explicit guidance system for space vehicles
[NAL-TR-258] N72-27931
OPTIMIZATION
Interference problems of airframe engine integration in aircraft design optimization
[AGARD-LS-53] N72-27016
Optimization techniques for estimating height-velocity diagram and critical decision point for rotorcraft based on impulsive response functions
[NAL-TR-245] N72-27026
Optimal quantization of chromatographic function based on Gaussian distribution
[NLL-TRANS-836-[9022.64]] N72-27143
Optimization technique for determining exact energy and wave functions in exchange perturbation processes
[NASA-CR-127265] N72-27154
Optimizing linear system against quadratic cost function and application to guidance and control system for tactical missiles
N72-27685
Air traffic control procedures for aircraft carrier operations based on trajectory optimization and computer-aided reassignment
[AD-739713] N72-27713
Development of optimal control theory and application to mass design of simply supported shear plate with fixed fundamental frequency of vibration
[NASA-CR-2044] N72-27945
ORBIT CALCULATION
Canonical satellite theory based on independent variables different from time
[ESRO-CR-[P]-76] N72-27625
Analysis of 15th-order geopotential coefficients obtained from orbit of Transit 1B
[RAE-TR-72003] N72-27899
ORBIT PERTURBATION
Effects of orbital perturbations on responses of gyroscope system for testing relativity theory in polar orbiting satellite
[AD-739500] N72-27712
ORBITAL MECHANICS
Orbital theory analysis and properties of gravitational potential function in relation to photogrammetry
N72-27845
ORGANIC COMPOUNDS
Properties of crystalline powders of organic compounds used for second harmonic generation of neodymium laser
N72-27551
Formation of rigid carbon fibers from COOH containing rayon fiber pyrolysis
[AD-739284] N72-27605
ORTHOGONAL FUNCTIONS
Normalized orthogonal exponential functions for approximating differential distribution laws
[NLL-M-22459-[5828.4F]] N72-27614
OSCILLATIONS
Numerical method for eigenvalue calculation in Laplace tidal equation for semidiurnal and diurnal oscillations
[NLL-M-22323-[5828.4F]] N72-27612
Collective oscillations of spherically symmetric systems of gravitational particles rotating in circular trajectories
[NASA-TT-F-14413] N72-27751
OSCILLATORS
Low cost telemetry subcarrier oscillator for high acceleration applications
[AD-739481] N72-27194
OV-1 SATELLITES
Three midlatitude, red auroral arcs observed from OV-1 satellite
[AD-737544] N72-27902
OV-10 AIRCRAFT
Measurement of aircraft noise generated by YOV-10A short takeoff aircraft and comparison with wind tunnel data
[NASA-TM-X-62166] N72-27031
OXIDATION
Stress rupture tests of brazed joints at elevated temperatures with emphasis on effects of oxidation
[NLL-LTI-746-1165-[9022.401]] N72-27941
OXIDATION RESISTANCE
High temperature tests to determine oxidation resistance and mechanical properties retention of porous alloy materials suitable for transpiration cooled vanes
[NASA-CR-1999] N72-27819
OXIDES
Measured output of germanium photovoltaic cell with erbium oxide and silicon carbide radiators
[AD-739489] N72-27072
OXYGEN
Tables of interpolation constants for calculation of transmittance and rate of dissociation of molecular oxygen in mesosphere and lower thermosphere
[NASA-TM-X-58084] N72-27349
OXYGEN PRODUCTION
Catalytic effect of cobalt powder on sodium chlorate candles as source of oxygen
N72-27131
Industrial procedures and safety practices involved in commercial production and handling of oxygen
[NLL-CE-TRANS-5849-[9022.09]] N72-27487
OXYGEN SUPPLY EQUIPMENT
Conference on portable life support systems for human protection
[NASA-SP-302] N72-27106
Effectiveness and limitations of current portable oxygen breathing equipment for mine rescue operations
N72-27107
Portable breathing apparatus containing chlorate candle oxygen source for mine rescue operations
N72-27112
Modified Apollo portable life support system for Skylab astronauts
N72-27117
Catalytic effect of cobalt powder on sodium chlorate candles as source of oxygen
N72-27131
OZONE
Ethylene chemiluminescence ozone detector for smog chamber studies
[BM-RI-7650] N72-27420

P

PAIR PRODUCTION
Calorimeter standard for determining energy of ion pair formation in air
[NLL-M-22434-[5828.4F]] N72-27417
PANELS
Ultrasonic adjustable scanner for flaw detection in flat or radial panels of honeycomb structure with welded seams
[NASA-CASE-MFS-20335-1] N72-27421
Thermal conductivity of honeycomb sandwich panels for spacecraft structures
[NLR-TR-71031-U] N72-27967
PARACHUTES
Wind tunnel tests to determine opening dynamics of parachutes inflating under finite mass conditions using solid flat and ringslot configurations
[AD-739554] N72-27046
PARALLEL PLATES
Monte Carlo method for variance reduction in analysis of rarefied gas diffusion between parallel walls
[NASA-TM-X-68094] N72-27156
PARAMETERIZATION
Parametrization of Meteosat radiometer for visible and infared ranges
N72-27466
PARTIAL DIFFERENTIAL EQUATIONS
Calculation of fields of partial derivatives in plastic deformations by method of Moire bands
[NLL-M-21376-[5828.4F]] N72-27615
PARTICLE ACCELERATOR TARGETS
Performance of solid and gaseous tritium targets as neutron generators
[NASA-TT-F-14337] N72-27719
PARTICLE COLLISIONS
Cross sections for emission of Lyman alpha radiation in collisions of 1-25 keV protons and hydrogen atoms with constituents of planetary atmospheres
[AD-739184] N72-27395
PARTICLE DIFFUSION
Proton diffusion data for 5 satellites nearest Jupiter
N72-27864
PARTICLE INTERACTIONS
Stability of ring current protons beyond plasmapause for injection spectrum model
[NASA CR-122447] N72-27347
Inclusive and exclusive multiparticle spectra for simple models of high energy hadronic interactions
[ILL-[TH]-72-7] N72-27758
PARTICLE MOTION
Controlled distribution of electrophoretic samples in flow path through conductive screens
[NASA-CASE-MFS-21395-1] N72-27425
PARTICLE SIZE DISTRIBUTION
Flotation processes for fine and coarse mineral particles
[NLL-RTS-6963] N72-27558
PARTICULATE SAMPLING
Collection apparatus for sampling of small solid particles from atmosphere
[NASA-CASE-HQN-10037-1] N72-27424
PATTERN RECOGNITION
Pattern recognition computer networks for layered input transformation processing
[NASA-CR-127266] N72-27208
PAYLOADS
Objectives, payloads, sampling, and return for Phobos/Deimos mission
[NASA-CR-112077-3] N72-27878
Large space program cost savings from low cost, refurbishable, and standard spacecraft
[NASA-CR-127117] N72-27913
Mission analysis and preliminary shuttle/payload constraints analysis
[NASA-CR-127118] N72-27914
PERFLUORO COMPOUNDS
Formation of polyurethane resins from hydroxy terminated perfluoro ethers
[NASA-CASE-NPO-10768-2] N72-27144
PERFLUOROALKANE
Synthesis of alpha, omega bis [hydroxy dimethyl silyl phenyl] perfluoro alkane thermally stable elastomer
[RAE-TR-71224] N72-27159
PERFORMANCE
Tungsten-rhenium electrode performance in cesium thermionic converters
[NASA-TM-X-68091] N72-27722
PERFORMANCE PREDICTION
Optimization techniques for estimating height-velocity diagram and critical decision point for rotorcraft based on impulsive response functions
[NAL-TR-245] N72-27026
Criteria for optimizing communication satellite transmission efficiency, noting lower and higher frequency predicted scintillations
[REPT-6-71] N72-27188
Data for estimating strength and performance of fillet-welded joints
N72-27501
Derivation of equation to predict rolling-element fatigue lives of through-hardened bearing steels combining effects of material hardness, carbide factor, and bearing temperature
[NASA-TM-X-68078] N72-27573
PERFORMANCE TESTS
Performance tests to determine problems associated with hovering, vertical takeoff, and landing of VTOL aircraft with emphasis on attitude control
[NAL-TR-276] N72-27027
Performance of closed circuit mixed gas underwater breathing apparatus
N72-27119
Life tests on crossed field amplifiers
[AD-738458] N72-27236
Performance tests on gyroscope and its fluid amplifier
[LRBA-E204-PV-5] N72-27471
Test and evaluation of antifriction bearings for use in turbine-alternator-compressor units of Brayton cycle electric power supply
[NASA-TM-X-68095] N72-27529
Thermal and oxidative stability test methods for fire resistant phosphate ester lubricants of gas turbines
[AD-738477] N72-27543
Performance tests of instrument landing system localizer to include system and monitor stability and monitor operation under degraded system performance
[FAA-RD-72-50] N72-27694
Performance and distortion tolerance of 1500 ft/sec tip speed transonic fan stage with variable geometry inlet guide vanes and variable stagger stator
[NASA-CR-72880] N72-27818
Design and performance tests of 5-cm diameter ion thruster
[NASA-TM-X-68110] N72-27825

Development of apparatus for detonating explosive devices in order to determine forces generated and detonation propagation rate
[NASA-CASE-LAR-10800-1] N72-27959

PERIODIC VARIATIONS
Horizontal gradients in ionospheric electron density and variations in Doppler frequency for satellite orbits
N72-27579

PERIPHERAL JET FLOW
Forward speed effect on lift power of two dimensional jet ground effect support
N72-27006

PERTURBATION
Nonspherical perturbations of relativistic gravitational field in collapsing star
N72-27841

PERTURBATION THEORY
Optimization technique for determining exact energy and wave functions in exchange perturbation processes
[NASA-CR-127265] N72-27154
Hydromechanical perturbation theory for cycloidal propellers
N72-27285
Numerical analysis of Hartree-Fock diagrams for ground state energies in perturbation field theory
[NASA-TT-F-14401] N72-27754
Collisional broadening of Landau levels in polar semiconductor noting high order perturbation effects
N72-27795

PHASE DIAGRAMS
Vacuum device used for plotting isothermal diagrams of titanium alloys by X ray diffraction method
[AD-739219] N72-27586

PHASE LOCKED SYSTEMS
Filter for third order phase locked loops used in signal receivers
[NASA-CASE-NPO-11941-1] N72-27249

PHASE TRANSFORMATIONS
Carbonization and thermal transformations of carbo- and hetero-chain polymers
[NLL-RTS-7032] N72-27142
Compositional limits of gamma and gamma prime phases in nickel base superalloys
[NASA-CR-120940] N72-27575

PHASED ARRAYS
Design of electronically controlled tracking radar system with phased arrays
[REPT-162] N72-27183

PHOBOS
Satellite rendezvous, landing, and roving mission to Phobos and Deimos
[NASA-CR-112077-2] N72-27877
Objectives, payloads, sampling, and return for Phobos/Deimos mission
[NASA-CR-112077-3] N72-27878
Combined mission planning for flights to Mars and Phobos/Deimos
[NASA-CR-112077-4] N72-27879

PHONEMES
Computer recognition of speech signals
[JPRS-56370] N72-27210

PHOSPHATES
Cholinesterase methods for assaying pesticide poisoning in blood of aerial applicator personnel
[FAA-AM-72-12] N72-27080
Feasibility determination for continuous automated analysis and control of production phosphate coating baths
[AD-739510] N72-27611

PHOTOCONDUCTIVITY
Performance limitations of onboard image analyzer, noting photoconductive and photoemissive tubes
N72-27444

PHOTODIODES
Cadmium telluride/mercury telluride photodiodes as onboard infrared detectors, noting hermetic sealing method
N72-27440

PHOTOELASTIC ANALYSIS
Photoelastic measurement of stresses on axial flow compressor disc with numerous pin hole perforations
[NAL-TR-274] N72-27948

PHOTOELECTRIC CELLS
Possible use of beta-silicon carbide as photocell material
[AD-739223] N72-27803

PHOTOELECTRIC EMISSION
Performance limitations of onboard image analyzer, noting photoconductive and photoemissive tubes
N72-27444
Photoemission from polymers under irradiation by 15 to 25 keV photons
[AD-739498] N72-27610
Photoemission energy distributions of aluminum oxide and evaporated aluminum films
[AD-739198] N72-27801

PHOTOELECTRIC MATERIALS
Possible use of beta-silicon carbide as photocell material
[AD-739223] N72-27803

PHOTOELECTRONS
Photoelectron effects in polar ion-exosphere and kinetic wind model
[A-N99-1972] N72-27371

PHOTOGRAMMETRY
Aircraft position and motion controlled by photogrammetric three reference point method noting coordinate transformations
[SAAB-TN-68] N72-27472
Orbital theory analysis and properties of gravitational potential function in relation to photogrammetry
N72-27845

PHOTOGRAPHY
X ray photography used to obtain thermal expansion data for nickel-chromium alloys
[AD-739301] N72-27588

PHOTOLUMINESCENCE
Onboard monochromator for calibration of near and mean ultraviolet, using single crystal fluorescence
N72-27464

PHOTOMETERS
Characteristics and applications of industrial photometers for analyzing constituent parts of liquid and gaseous mixtures
[NLL-SMRE-TRANS-5691-[8313.4]]
N72-27414
Functional characteristics of OGO-4 main body airglow photometer utilizing cathode photomultiplier to sense light at selected wavelengths
[NASA-TM-X-65926] N72-27423

PHOTOMULTIPLIER TUBES
Time resolution measurements of energetic electrons in auroral breakup, and electron multiplier
[NASA-CR-127522] N72-27346
Design and development of light sensing device for controlling orientation of object relative to sun or other light source
[NASA-CASE-NPO-11201] N72-27409
Onboard photomultiplier tubes sensitive to ultraviolet radiation developed for Signe, OSO, and D2B projects
N72-27436
High resolution photomultiplier tube for onboard far ultraviolet photometer in aerospace environment
N72-27441
Microchannel electron multiplier array for double proximity focusing image tube design
N72-27442
High speed compact, and robust microchannel plate photomultiplier for use as onboard radiation detectors
N72-27443

PHOTOSYNTHESIS
Photosynthesis and photovoltaic technology
N72-27060

PHOTOVOLTAIC CELLS
Maximum efficiency of solar energy conversion for photovoltaic cells
N72-27058
Measured output of germanium photovoltaic cell with erbium oxide and silicon carbide radiators
[AD-739489] N72-27072

PHOTOVOLTAIC EFFECT
Physical processes underlying solar-energy conversion through photovoltaic effect
N72-27057
Photosynthesis and photovoltaic technology
N72-27060

PHYSICAL PROPERTIES
Physical properties and costs of designing ultimate computer
[P-4825] N72-27212
Effects of hardness and microstructure of carbides of transition metals on abrasive wear resistance properties
[NLL-RTS-7289] N72-27513
Applications, production, and physical properties of high temperature fiber composites
[NLL-TRANS-746-1195-[9022.401]]
N72-27599
Properties of superconducting materials and bibliography
[NBS-TN-724] N72-27790
Empirical equations for calculating heating and cooling effects on thermal and physical properties of steel
[NLL-M-21368-[5828.4F]] N72-27962

PHYSIOLOGICAL EFFECTS
Properties of silicon and silicon nitride and physiological effects on rats
[NLL-RTS-7103] N72-27594

PIEZOELECTRIC CRYSTALS
Properties of crystalline powders of organic compounds used for second harmonic generation of neodymium laser
N72-27551

PIEZOELECTRIC TRANSDUCERS
Triaxial piezoelectric accelerometer with sensitivity to extend upper limit of falling sphere type of upper atmospheric density measuring system
[AD-739202] N72-27473

PILE FOUNDATIONS
Portable air supply and monitoring system for personnel working on offshore platform piling
N72-27123

PILOT ERROR
Pilot steering error in simulated instrument flight approach to terminal area
[AD-739309] N72-27085

PILOT PERFORMANCE
Six degree of freedom simulator tests to determine effects of motion cues on short takeoff and landing aircraft approach
[NASA-CR-114458] N72-27032
Analysis of pilot performance in establishing specific glide path by reference to oblong diamond marks on runway
[FAA-NA-72-57] N72-27702

PILOTS [PERSONNEL]
Importance of advanced information given to pilots considered as element in automatic control system
[REPT-64] N72-27034

PIONEER SPACE PROBES
Jupiter radiation belt models, radiation effects, earth-based observations of Jupiter magnetosphere, and Pioneer F and G missions - conference
[NASA-CR-127124] N72-27850
Environmental impact survey of Pioneer F/G program
[NASA-TM-X-68543] N72-27904

PIONEER 6 SPACE PROBE
Pioneers F and G experiments of gating energetic charged particle detectors, plasma analyzer, and magnetometer for assessing Jupiter radiation belts
N72-27872

PIONEER 7 SPACE PROBE
Pioneers F and G experiments of gating energetic charged particle detectors, plasma analyzer, and magnetometer for assessing Jupiter radiation belts
N72-27872

PIONS
Two particle distribution functions in pionization region of multiperipheral model
[TUEP-72-17] N72-27762
Interactions of nucleons bound in heavy nuclei with high energy cosmic rays
[NASA-TT-F-14409] N72-27832

PIPELINES
Statistical analysis of frequency distribution in mineral oil pipeline pressure variations
[FB-93] N72-27325
Design method for estimating fatigue life of seam-welded pipelines subjected to fluctuating pressures
N72-27499

PIPES [TUBES]
Extent of transition zone and heat transfer during mixed flow of air in pipes
[AD-739210] N72-27328
High integrity tube-to-tubeplate bore welds for sodium cooled fast reactor
N72-27505
Heat exchanger tube-to-tubeplate welded joints for thin walled tubes
N72-27506
Characteristics of drop-weight tear tests to determine mechanical properties of plates and large tubes
[NLL-T1512/ERS/72-[9022.305]]
N72-27943

PLANE WAVES
Matrix method for analyzing polarization properties of plane waves
[NASA-CR-127271] N72-27167

PLANETARY ATMOSPHERES
Cross sections for emission of Lyman alpha radiation in collisions of 1-25 keV protons and hydrogen atoms with constituents of planetary atmospheres
[AD-739184] N72-27395

PLANETARY MAGNETIC FIELDS
Jupiter decametric radiation data on burst sources, frequency drift rates, Io influence, magnetic field strength, and plasmapause location
N72-27860
Jupiter decimetric data on brightness contour maps, emission centroid position, circular polarization and magnetic field strength, and Faraday rotation and thermal electron density
N72-27861

PLASMA DIAGNOSTICS
Application of Fabry-Perot interferometers and duochromators to plasma diagnostics
[AD-738633] N72-27782

PLASMA GENERATORS
Computer aided analysis of electric and fluid fields in electrofluid dynamic generators
[AD-739547] N72-27070
Plasma generation in free air, explosive electron emission, and superstrong pulsed magnetic fields
[AD-739324] N72-27779

PLASMA JETS
Langmuir probe surface contamination noting plasma jet simulation, decontamination methods, and material selection
[ESRO-SN-115-ESTEC] N72-27531

PLASMA LAYERS
Formation and stability of double layers in plasmas, and occurrence in ionosphere and solar atmosphere
[TRITA-EPP-72-09] N72-27778

PLASMA PHYSICS
Four-phase tube generators for excitation of circuits shaping high frequency fields of configurations used in plasma physics research
[JPRS-56371] N72-27254

Convective electric field and magnetospheric plasma observations using Explorer 40 satellite
[NASA-CR-127254] N72-27350
PLASMA SHEATHS
Magnetosheath plasma entry into earth magnetosphere
[NASA-CR-127424] N72-27776
Formation and stability of double layers in plasmas, and occurrence in ionosphere and solar atmosphere
[TRITA-EPP-72-09] N72-27778
PLASMAPAUSE
Explorer 45 plasmapause measurements
[NASA-TM-X-65931] N72-27432
Jupiter decametric radiation data on burst sources, frequency drift rates, Io influence, magnetic field strength, and plasmapause location
N72-27860
PLASTIC DEFORMATION
Calculation of fields of partial derivatives in plastic deformations by method of Moire bands
[NLL-M-21376-[5828.4F]] N72-27615
PLASTIC FLOW
Liquid environment effect on ceramics fracture toughness noting plastic flow induction
[WB-5/71] N72-27956
PLASTIC PROPERTIES
Plasticity and ductility of metals subjected to high pressure
[NLL-NEL-TT-2371-[6075.461]]
N72-27564
PLASTICIZERS
Internal plasticization of aromatic polyesters by side chain alkylation noting 5 alkyl resorcinol isophtalate polymer glass transition temperature measurements
[RAE-TR-71223] N72-27158
PLATINUM
Anion effect in hydrogen adsorption on platinum electrode
[NASA-TT-F-14361] N72-27152
Calibration of thermocouples at melting point of platinum by small batch method
[AD-738748] N72-27474
PLATINUM ALLOYS
Conversions in Pt-Fe system, and proof of super lattices Fe3Pt and FePt3
[NASA-TT-F-14320] N72-27576
PLOTTING
Computerized graph techniques based on algorithms with several applications including molecular structures and networks
[REPT-127] N72-27221
PLUTONIUM 238
Global fallout measurements of Pu-238 from SNAP-9A burnup
[HASL-250] N72-27724
PNEUMATIC CONTROL
Operational performance of pneumatic seal-type facemask design
N72-27130
POINT TO POINT COMMUNICATIONS
Microwave power amplifier and processing system for superhigh frequency transmission by Communications Technology Satellite
[NASA-TM-X-68106] N72-27177
Review of microwave communication links
[AD-738694] N72-27191
POINTING CONTROL SYSTEMS
Onboard star tracker with coded pointing system for Meteosat attitude control
N72-27459
POLAR ORBITS
Effects of orbital perturbations on responses of gyroscope system for testing relativity theory in polar orbiting satellite
[AD-739500] N72-27712
POLAR REGIONS
Correlations between azimuthal direction of interplanetary magnetic field and polar cap electric field distributions
[NASA-TM-X-65934] N72-27365
Photoelectron effects in polar ion-exosphere and kinetic wind model
[A-N99-1972] N72-27371
Analysis of very low frequency auroral zone in Alaska to determine effect on accuracy of Omega navigation system in polar regions
[AD-739689] N72-27714
POLARITY
Variations in interplanetary magnetic field polarity and solar magnetic cycle
[NASA-CR-127422] N72-27370
POLARIZATION [CHARGE SEPARATION]
Low field transport properties of polar semiconductors in parallel strong magnetic and weak electric fields, and computation of distribution functions
N72-27796
POLARIZATION CHARACTERISTICS
X ray and laser irradiation of glycol sulfate crystals in relation to nucleation and spontaneous polarization
[NLL-TRANS-855-[9022.64]] N72-27148
Matrix method for analyzing polarization properties of plane waves
[NASA-CR-127271] N72-27167
Low field transport properties of polar semiconductors in parallel magnetic and electric fields, noting distribution functions
N72-27797
POLARIZED RADIATION
Distribution of linearly polarized lunar thermal emission at wavelength of 3.1 mm
[NASA-CR-127273] N72-27848
POLYESTERS
Internal plasticization of aromatic polyesters by side chain alkylation noting 5 alkyl resorcinol isophtalate polymer glass transition temperature measurements
[RAE-TR-71223] N72-27158
POLYHEDRONS
Intersecting all edges of centrally symmetric polyhedra by hyperplanes
[AD-739711] N72-27628
POLYMER PHYSICS
Photoemission from polymers under irradiation by 15 to 25 keV photons
[AD-739498] N72-27610
POLYMERS
Carbonization and thermal transformations of carbo- and hetero-chain polymers
[NLL-RTS-7032] N72-27142
POLYURETHANE RESINS
Formation of polyurethane resins from hydroxy terminated perfluoro ethers
[NASA-CASE-NPO-10768-2] N72-27144
Fluorinated polyurethanes produced by reacting hydroxy terminated perfluoro polyether with diisocyanate
[NASA-CASE-NPO-10767-2] N72-27151
POROUS MATERIALS
Compressible electrolyte saturated sponge electrode for biomedical applications
[NASA-CASE-MSC-13648] N72-27103
PORTABLE EQUIPMENT
Engineering evaluation of AA size primary, nonreserve zinc-air batteries for use in portable communications equipment
[AD-739490] N72-27073
Effectiveness and limitations of current portable oxygen breathing equipment for mine rescue operations
N72-27107
PORTABLE LIFE SUPPORT SYSTEMS
Conference on portable life support systems for human protection
[NASA-SP-302] N72-27106
Design of gas mixture breathing systems for underwater diver equipment
N72-27108
Portable life support system for astronaut working outside of lunar module
N72-27109
Performance of Apollo portable life support system on lunar mission
N72-27110
Portable life support system for protective fully enclosed suits of shipboard personnel
N72-27111
Portable breathing apparatus containing chlorate candle oxygen source for mine rescue operations
N72-27112
Regenerative portable life support system development for extravehicular human activities during advanced space missions
N72-27113
Carbon dioxide- and thermal-control in regenerative life support system for extravehicular human protection during advanced space missions
N72-27114
Design of auxiliary survival shelter as portable life support system in mines
N72-27115
Design of portable decompression chamber with semiclosed gas recirculation system for treating underwater divers
N72-27116
Modified Apollo portable life support system for Skylab astronauts
N72-27117
Design of deep sea heavy duty diving equipment for salvage divers
N72-27118
Performance of closed circuit mixed gas underwater breathing apparatus
N72-27119
Diving suit and heat element combinations for thermal protection of underwater divers
N72-27120
Performance of liquid cooled garment system inside pressure suit of pilot
N72-27121
Design and performance of prototype portable heat source for providing thermal insulation in diving suit
N72-27122
Portable air supply and monitoring system for personnel working on offshore platform piling
N72-27123
Water cooled pressure suit with regional body cooling for metabolic heat removal
N72-27124
Automatic controller of liquid cooled space suit using human sweat rate as input signal
N72-27125
Neck cooling collar for improved thermal comfort in hot weather
N72-27126
Operational performance of pneumatic seal-type facemask design
N72-27130
PORTUGAL
Ground based Portugal observations of luminous magnetospheric phenomena caused by barium ion release
[AERONOMICA-ACTA-A-102] N72-27372
POSEIDON MISSILES
Converter modules for underwater to surface guided missiles
[AD-739248] N72-27222
POSITION [LOCATION]
Finding meridian for base stationary relative to earth using angular acc erometer
N72-27698
Data reductation and spacecraft position determination used in two ATS experiments
[NASA-TM-X-65920] N72-27885
POSITION INDICATORS
Aircraft position and motion controlled by photogrammetric three reference point method noting coordinate transformations
[SAAB-TN-68] N72-27472
POSITIONING DEVICES [MACHINERY]
Positioning device using mechanical drive [bevel gears] as digital to analog converter
[REPT-57] N72-27532
Optical system for monitoring angular position of rotating mirror
[NASA-CASE-GSC-11353-1] N72-27736
POTASSIUM
Active transport of Na and K ions and reaction mechanism for ATP-ase
[NLL-RTS-6898] N72-27075
POTENTIAL THEORY
Limit theorems, Markov processes, additive functionals, and potential theory
[AD-739983] N72-27629
POWDER METALLURGY
Various powder metallurgy and quench lasting techniques used in billet processing to generate extremely fine dendrite arm spacings and homogenous structures
[AD-739340] N72-27580
POWER SUPPLIES
Analysis of secondary power system for use with advanced rotary wing aircraft for reliable production of electric power
[AD-739480] N72-27069
Development and characteristics of power supply for carbon dioxide laser
[NASA-CASE-GSC-11222-1] N72-27548
PRECIPITATION [METEOROLOGY]
Microphysical diffusion model of rapid glaciation in supercooled clouds for studying precipitation from artificial seeding of layer-type orographic clouds
[TN-42] N72-27643
Ice crystal terminal velocities for calculating ice crystal growth in clouds, evaporation in subcloud regions, and precipitation rates
[NASA-CR-127428] N72-27645
Weather modification research and development by Navy
[AD-739364] N72-27667
PRECIPITATION HARDENING
Discontinuous deformation as function of strain rate and temperature in spherulitic graphite iron
[NLL-TRANS-746-1167-[9022.401]]
N72-27562
PREDICTION ANALYSIS TECHNIQUES
Ionospheric oscillation prediction technique for optimizing signal transmission of navigation satellite used as radio relay systems
[REPT-7-71] N72-27189
Feasibility of prediction models for estimating reliability of large scale integration microcircuits
[NASA-CR-123714] N72-27515
PREDICTIONS
Mathematical theory of predicting and controlling pulse processes in signed digraphs
[R-926-NSF] N72-27618
PRELAUNCH PROBLEMS
Development of procedures for preparation of space vehicle and launch vehicle for subsequent launch following cancellation of prior attempt
[NASA-TM-X-68516] N72-27917
PRELAUNCH TESTS
Development of procedures for preparation of space vehicle and launch vehicle for subsequent launch following cancellation of prior attempt
[NASA-TM-X-68516] N72-27917
PRESSURE
Standarized treatment of decompression sickness occurring while diving under pressure
[AD-737700] N72-27088

PRESSURE CHAMBERS
Design of portable decompression chamber with semiclosed gas recirculation system for treating underwater divers
N72-27116

PRESSURE DISTRIBUTION
Hypersonic wind tunnel tests on delta wing models at high incidence for pressure distribution determination
[ARC-CP-1198] N72-27004
Pitot pressure distributions of scale model of delta wing, space shuttle orbiter
[NASA-TM-X-62122] N72-27292
Computer program for airfoil pressure distribution for subcritical viscous attached flow
[NAL-TR-248] N72-27317
Wind tunnel tests to determine pressure distribution of space shuttle abort stage under various conditions of Mach number, Reynolds number, and angles of attack - Vol. 1, Pt. A
[NASA-CR-120008-VOL-1-PT-A] N72-27924
Wind tunnel tests to determine pressure distribution on space shuttle scale model in abort mode configuration under various aerodynamic conditions -Vol. 1 Pt. B
[NASA-CR-120008-VOL-1-PT-B] N72-27925
Wind tunnel tests to determine abort separation pressures on space shuttle orbiter at Mach 5 - Vol. 2 Pt B
[NASA-CR-120061] N72-27926
Wind tunnel tests to determine pressure distribution on space shuttle booster in abort configuration at Mach 3 - Vol. 3
[NASA-CR-120062] N72-27927
Wind tunnel tests to determine pressure distribution on space shuttle orbiter in abort configuration at Mach 3 - Vol. 4
[NASA-CR-120063] N72-27928
Wind tunnel tests to determine pressure distribution on space shuttle booster in abort configuration at Mach 2 - Vol. 5
[NASA-CR-120064] N72-27929
Wind tunnel tests to determine pressure distribution on space shuttle orbiter in abort configuration at Mach 2 - Vol. 6
[NASA-CR-120065] N72-27930

PRESSURE GRADIENTS
Formulas for laminar compressible similar boundary layers with heat transfer, adverse pressure gradient, and constant cross flow
[AD-739864] N72-27335

PRESSURE MEASUREMENTS
Method for designing wind tunnel model airfoil with integrally formed pressure measurement orifices
[NASA-CASE-LAR-10812-1] N72-27272

PRESSURE OSCILLATIONS
Inlet random pressure fluctuation effects on turbojet engine stall characteristics
N72-27022
Statistical analysis of frequency distribution in mineral oil pipeline pressure variations
[FB-93] N72-27325
Design method for estimating fatigue life of seam-welded pipelines subjected to fluctuating pressures
N72-27499

PRESSURE SUITS
Conference on portable life support systems for human protection
[NASA-SP-302] N72-27106
Portable life support system for protective fully enclosed suits of shipboard personnel
N72-27111
Diving suit and heat element combinations for thermal protection of underwater divers
N72-27120
Performance of liquid cooled garment system inside pressure suit of pilot
N72-27121
Design and performance of prototype portable heat source for providing thermal insulation in diving suit
N72-27122
Water cooled pressure suit with regional body cooling for metabolic heat removal
N72-27124

PRESSURE VESSEL DESIGN
Improved design of welded LD vessels used in steel production
N72-27508

PRESSURE VESSELS
Design codes which determine quality and overall cost of pressure vessels constructed in carbon and carbon-manganese steel
N72-27492
Hydrogen embrittlement and carbide disintegration of metals used in pressure vessels
N72-27494
Toughness of heat-affected zone of stress-relieved, automatic submerged-arc, pressure vessel seam weld in steels
N72-27496
Behavior of nuclear power plant pressure vessel insulations in helium
[NLL-WH-TRANS-321-[9091.9F]] N72-27716

PRESSURIZED CABINS
Standard formula for allowable cabin leakage in military aircraft
[AD-739687] N72-27048
Viability of staphylococci isolated from humans subjected to long term isolation in pressurized cabins
[NLL-RTS-7117] N72-27074

PRIMERS [COATINGS]
Corrosion inhibiting properties of epoxy primers used in aluminum alloys
[AD-738446] N72-27606

PROBLEM SOLVING
Solution of nonlinear Lee nuclear field theoretical model in Hilbert space
[NOTA-INTERNA-356] N72-27769

PROCUREMENT MANAGEMENT
Procurement research and cost estimates of DOD and NASA
[AD-738983] N72-27987

PRODUCTION ENGINEERING
Industrial procedures and safety practices involved in commercial production and handling of oxygen
[NLL-CE-TRANS-5849-[9022.09]] N72-27487
Conference on improving welded product design
N72-27491
Benefits of using high voltage electron beam welding on product design and production applications
N72-27503
Design requirements for components to be electron beam welded
N72-27504
Precision electron beam welding and equipment for industrial production applications
[AD-739282] N72-27536
Feasibility determination for continuous automated analysis and control of production phosphate coating baths
[AD-739510] N72-27611
Analysis of condition of service and manufacturing technology in US and recommendations for stimulating advancement
[P-4806] N72-27983

PROJECTILES
Evaluation of dynamic stability of projectiles based on pitch damping moment transverse radius of gyration, and Magnus moment
[AD-738016] N72-27005

PROPAGATION
Sound ray theory for analyzing effects of horizontal gradients on acoustic wave propagation velocity in channels
N72-27727
Solar flare protons and physical processes affecting particle propagation in interplanetary space
N72-27829

PROPELLANTS
Nuclear heating effects on propellant and structures of reusable nuclear shuttle configuration
[NASA-CR-2042] N72-27718

PROPELLER BLADES
Development of composite structure for propeller blade retention on V/STOL aircraft propulsion system
[AD-739555] N72-27047

PROPELLER EFFICIENCY
Hydromechanical perturbation theory for cycloidal propellers
N72-27285

PROPORTIONAL COUNTERS
Gas proportional counter for solar wind ions, H and He ions of interstellar origin, and faint optical emission lines for interstellar gas
[NASA-CR-127274] N72-27831

PROPULSION SYSTEM CONFIGURATIONS
Separated flow point determination on blown flap airfoil of STOL wing propulsion system
N72-27286

PROPULSION SYSTEM PERFORMANCE
Design, analysis, and performance of space shuttle auxiliary power systems
[NASA-CR-1995] N72-27054

PROTECTIVE CLOTHING
Steady state and transient temperature distributions in human thigh covered with cooling pad
[NASA-CR-127523] N72-27084
Inflatable, thermally insulative emergency survival suit for subzero weather
N72-27132

PROTECTIVE COATINGS
Development and characteristics of device for applying multiple layers of noble metal to glass substrate for protection of optical surfaces
[NASA-CASE-LAR-10362-1] N72-27486
Measurement of thickness of metallic coating on plastic sheet using two capacitive probes connected in bridge circuit
[NLL-293-[8660.5]] N72-27512
Inspection techniques for coated refractory metals and filamentary composites
N72-27518
Feasibility determination for continuous automated analysis and control of production phosphate coating baths
[AD-739510] N72-27611

PROTON DENSITY [CONCENTRATION]
Model for electron and proton energy and density in Jupiter radiation belt
N72-27851

PROTONS
Stability of ring current protons beyond plasmapause for injection spectrum model
[NASA CR-122447] N72-27347
Calculated electron and proton dose rates in Jupiter radiation belts
N72-27852
Estimates of energetic electron and proton fluxes in Jupiter radiation belts, dose rates for shielding, and radiation lifetimes of electronic circuits
N72-27854
Specific and monograph models of energetic electrons and protons in Jupiter magnetosphere
N72-27855
Uncertainties in electron and proton flux models and resulting uncertainties in fluences for Jupiter flyby missions
N72-27857
Electron and proton energies, densities, and fluxes from 1 to 6 Jupiter radii
N72-27863
Proton diffusion data for 5 satellites nearest Jupiter
N72-27864
Location, density, and energy of energetic protons in Jupiter radiation belts
N72-27865
Proton fluxes in Jupiter magnetosphere from cosmic ray albedo neutron decay
N72-27866
Pitch-angle diffusion and stably trapped limits for protons in Earth and Jupiter magnetospheres
N72-27867
Upper limits of electron and proton fluxes in Jupiter radiation belts, using radial diffusion for getting solar wind fluxes into inner regions of belts
N72-27868
Ion cyclotron instability and upper flux limits for protons in Jupiter magnetosphere
N72-27870
Geiger-Mueller tube epxeriment package for Pioneers F and G to study energetic electrons and protons in Jupiter magnetosphere
N72-27871

PSYCHOPHYSIOLOGY
Human factors engineering viewpoint of psychophysiological measurements applied to maintainability evaluation of equipment design
[AD-739437] N72-27137

PULSE CODE MODULATION
Asynchronous vocoder sampling and pulse coding of speech
[NASA-CR-127256] N72-27205

PULSE COMPRESSION
Computerized simulation of radar sidelobe clutter reduction by pulse compression
[AD-739512] N72-27195

PULSE DURATION
Characteristics of pulsed carbon dioxide laser and methods for producing powerful ultrashort pulse of laser emission
[NLL-DRIC-TRANS-2644-[3623.66]] N72-27547

PULSE GENERATORS
Four-phase tube generators for excitation of circuits shaping high frequency fields of configurations used in plasma physics research
[JPRS-56371] N72-27254

PULSED RADIATION
Construction of liquid laser system to produce high energy pulses
[AD-739715] N72-27554

PULSES
Mathematical theory of predicting and controlling pulse processes in signed digraphs
[R-926-NSF] N72-27618

PUMPS
Oil diffusion pumps vs mercury pumps, using varied organic driving media
[NASA-TT-F-14276] N72-27530

PYRAMIDAL BODIES
Resistance of pyramidal shaped bodies in supersonic flow
[AD-739293] N72-27333

PYROLYSIS
Vacuum thermal decomposition of combustion intermediates from reaction of N2O4 with N2H4
[AD-739187] N72-27163
Formation of rigid carbon fibers from COOH containing rayon fiber pyrolysis
[AD-739284] N72-27605

Q

QUALITY CONTROL
Relevance of quality control tests by material producer to welded design
N72-27497
Training requirements for welding design
N72-27502

Advanced methods of reliability engineering and quality assurance for aerospace application
[NASA-TM-X-64666] N72-27516
Quality and reliability requirements for hybrid microcircuits in space flight applications
N72-27520
Nondestructive test techniques for quality control of electroexplosive devices used for spacecraft equipment actuators
[NASA-CR-127255] N72-27964

QUANTITATIVE ANALYSIS
Quantitative values of luminance and radiance from high density nanosecond spark channels
[AD-739253] N72-27741

QUARKS
Effect of radial wave functions for baryons in symmetric quark model
[TR-72-122] N72-27765
Radial baryon excitation modes in symmetric quark model
[TR-72-088] N72-27766

QUASARS
Infrared photometry of galactic and quasar nuclei
[AD-739196] N72-27901

QUENCHING (COOLING)
Quenching after hot deformation for improved mechanical properties of steels
[PB-207425] N72-27545
Fracture strength of high strength steel HFX 103 after quenching and annealing for weldability assessment
[T-MITT-4/71] N72-27579
Various powder metallurgy and quench lasting techniques used in billet processing to generate extremely fine dendrite arm spacings and homogenous structures
[AD-739340] N72-27580

QUEUEING THEORY
Procedures for determining capacity of air traffic control systems and application to long range planning, management decisions, and system performance evaluation
[AD-738892] N72-27710

R

RADAR
Average pulse shape measurements of radar sea return at near vertical incidence
N72-27651

RADAR DATA
Statistical analysis of ground and weather clutter data on magnetic digital tape recordings
[REPT-165] N72-27185
Statistical analysis of radar target and clutter data on magnetic digital tape recordings
[REPT-175] N72-27186

RADAR ECHOES
Computerized simulation of radar sidelobe clutter reduction by pulse compression
[AD-739512] N72-27195

RADAR EQUIPMENT
Characteristics and operation of air trafic control radar system installed at USSR airports
[JPRS-56463] N72-27705

RADAR IMAGERY
Meteorological radar surveillance of atmospheric conditions during artillery tests conducted in Panama
[AD-739485] N72-27666

RADAR RANGE
Sequential tests for radar target recognition with multiple range elements
[REPT-177] N72-27187

RADAR TARGETS
Statistical analysis of radar target and clutter data on magnetic digital tape recordings
[REPT-175] N72-27186
Sequential tests for radar target recognition with multiple range elements
[REPT-177] N72-27187

RADAR TRACKING
Alpha-beta method of linear prediction by radar tracking of flying target, taking into account maximum acceleration
[REPT-154] N72-27182
Electronically controlled radar tracking with Kalman filtering
[REPT-173] N72-27184

RADIAL DISTRIBUTION
Spherical particle dissolution in spherical water drop governed by radial diffusion equation
[AD-739323] N72-27654
Effect of radial wave functions for baryons in symmetric quark model
[TR-72-122] N72-27765

RADIANT FLUX DENSITY
Solar cycle effects on excess radiation intensity at low altitudes
N72-27839

RADIANT HEATING
High heating rate, thermoanalytical technique for studying condensed phase reactions of binder fuels and ammonium perchlorate based, propellant-like materials
N72-27813

RADIATION BELTS
Jupiter radiation belt models, radiation effects, earth-based observations of Jupiter magnetosphere, and Pioneer F and G missions - conference
[NASA-CR-127124] N72-27850
Model for electron and proton energy and density in Jupiter radiation belt
N72-27851
Calculated electron and proton dose rates in Jupiter radiation belts
N72-27852
Equatorial electron energy, number density, and radiative half life in Jupiter magnetosphere, based on synchrotron model with Maxwellian energy distribution
N72-27853
Estimates of energetic electron and proton fluxes in Jupiter radiation belts, dose rates for shielding, and radiation lifetimes of electronic circuits
N72-27854
Specific and monograph models of energetic electrons and protons in Jupiter magnetosphere
N72-27855
Design fluences for electrons and protons and damage effects from low energy electrons and protons for spacecraft in Jupiter radiation belts
N72-27856
Uncertainties in electron and proton flux models and resulting uncertainties in fluences for Jupiter flyby missions
N72-27857
Radiation effects of electrons and protons trapped in Jupiter radiation belts on scientific instruments and electronic components
N72-27858
Jupiter radiation environmental impact on TOPS 12L design
N72-27859
Electron and proton energies, densities, and fluxes from 1 to 6 Jupiter radii
N72-27863
Location, density, and energy of energetic protons in Jupiter radiation belts
N72-27865
Upper limits of electron and proton fluxes in Jupiter radiation belts, using radial diffusion for getting solar wind fluxes into inner regions of belts
N72-27868
Ion cyclotron instability and upper flux limits for protons in Jupiter magnetosphere
N72-27870
Pioneers F and G experiments of gating energetic charged particle detectors, plasma analyzer, and magnetometer for assessing Jupiter radiation belts
N72-27872
Best estimate and upper limit models for Jupiter electron and proton trapped radiation belt
N72-27873
Models for charged particle populations of Jupiter trapped radiation belts
N72-27875

RADIATION DAMAGE
Opthalmologic examinations for determining retina damage caused by helium-neon laser boresights
[AD-738629] N72-27087
Effect of gamma irradiation on first constant of magnetic crystallographic anisotropy of single crystals of nickel and nickel copper ferrites
[AD-739286] N72-27805
Design fluences for electrons and protons and damage effects from low energy electrons and protons for spacecraft in Jupiter radiation belts
N72-27856

RADIATION DETECTORS
Onboard photomultiplier tubes sensitive to ultraviolet radiation developed for Signe, OSO, and D2B projects
N72-27436

RADIATION DOSAGE
Calculated electron and proton dose rates in Jupiter radiation belts
N72-27852

RADIATION EFFECTS
Nuclear radiation effects on Saturn 5 materials and design of reusable nuclear shuttle
[NASA-CR-2045] N72-27717
Nuclear heating effects on propellant and structures of reusable nuclear shuttle configuration
[NASA-CR-2042] N72-27718
Irradiation effects on reactor structural materials, including stainless steels and iron alloys
[AD-739312] N72-27726
Radiation effects of electrons and protons trapped in Jupiter radiation belts on scientific instruments and electronic components
N72-27858
Jupiter radiation environmental impact on TOPS 12L design
N72-27859

RADIATION SOURCES
Onboard optical equipment, radiation sources and detectors for aerospace environments - conferences
N72-27435

RADIO ALTIMETERS
Radar altimeter design for high altitude balloon flights
N72-27650

RADIO BEACONS
Methods for performing evaluation and processing data following flight tests of air traffic control beacon
[AD-738680] N72-27709

RADIO BURSTS
Jupiter decametric radiation data on burst sources, frequency drift rates, Io influence, magnetic field strength, and plasmapause location
N72-27860

RADIO COMMUNICATION
Titles and authors of reports from Second Scientific Technical Conference on Radio Communication
[NASA-TT-F-14406] N72-27169

RADIO FREQUENCY INTERFERENCE
Criteria for optimizing communication satellite transmission efficiency, noting lower and higher frequency predicted scintillations
[REPT-6-71] N72-27188

RADIO INTERFEROMETERS
VHF correlation radio interferometer consisting of two superheterodyne receivers for investigating ionospheric disturbances by receiving signals from ATS satellites
[NASA-CR-127270] N72-27345

RADIO NAVIGATION
Characteristics of air navigation systems and methods for improving accuracy of navigation instruments and systems
[JPRS-56487] N72-27704

RADIO TELEMETRY
Docking manned spacecraft and radio telemetry
[JPRS-56464] N72-27881
Radio telemetry for spacecraft
N72-27883

RADIO TRANSMISSION
Analysis of very low frequency auroral zone in Alaska to determine effect on accuracy of Omega navigation system in polar regions
[AD-739689] N72-27714
Systematic procedure for identifying spatial regimes of various modes of radio wave propagation in Jupiter magnetosphere to be ecountered by flyby missions
N72-27869

RADIOACTIVE MATERIALS
Error source in micro-weighting of radioactivity drop
[NLL-M-22443-[5828.4F]] N72-27749

RADIOGRAPHY
Applications and operational constraints of conventional X radiographic and neutron imaging techniques
N72-27517
X ray photography used to obtain thermal expansion data for nickel-chromium alloys
[AD-739301] N72-27588

RADIOMETERS
Combined analysis of data on radiometric satellite and wind waves from Cosmos 243
[NASA-TT-F-14400] N72-27170
Parametrization of Meteosat radiometer for visible and infared ranges
N72-27466
Specifications and performance of mechanical scanning infrared radiometer for earth cloud cover onboard Meteosat
N72-27467
Specifications for Meteosat radiometer including telescope, infrared and visible radiation detectors, detector subsystems, and electronic equipment
N72-27468

RAIN
Time lapse cloud brightness data from ATS 3 and correlation of cirrus shield variations in time to rainfall rate in midlatitude storm complexes
N72-27648
Relationship between cloud brightness, rainfall, and runoff in Surinam
N72-27649

RANDOM PROCESSES
Decomposition of random sequence formed by discretization of continuous stationary random process in terms of column vectors of normalized Hadamard matrix
[NASA-TT-F-13897] N72-27616

RAYLEIGH WAVES
Rayleigh wave detection from Kurile Island earthquakes
[AD-739174] N72-27396

RAYLEIGH-RITZ METHOD
Vibration analysis of three parallel beams with different rigidities based on Rayleigh-Ritz method with three approximated deflection functions
[NAL-TR-271] N72-27949

RAYON
Formation of rigid carbon fibers from COOH containing rayon fiber pyrolysis
[AD-739284] N72-27605

REACTION CONTROL
Thruster attitude control simulation for designing and evaluating reaction control system
[NASA-TM-X-64660] N72-27815
REACTION KINETICS
Computer program for chemical reaction kinetics and transient states
[P-4812] N72-27157
Kinetic and energetic behavior of vibrationally excited hydrogen molecules
[AD-739524] N72-27165
Reaction kinetics and microstructure resulting from interaction of Ni coating and Sn-Pb solder
[NLL-TRANS-746-1155-[9022.401]] N72-27566
Simple classical mechanical model for reactive scattering of atom and quasi-diatomic molecule using conservation relations
[NASA-CR-127260] N72-27756
Optimal means of characterizing product and reactant energy distributions in molecular collisions, information content of internal state distribution, and entropy deficiency
[NASA-CR-127261] N72-27757
Analysis of carbon monoxide, unburned hydrocarbons, and nitrogen oxides in turbojet afterburner combustion products using infrared spectroscopy - Part I
[AD-739176] N72-27968
REACTION TIME
Response time to vibrotactile stimulus in relation to signal amplitude and frequency variation
[AD-739433] N72-27139
REACTOR CORES
Reactor heated in-core diodes for energy conversion
[NASA-CASE-NPO-10542] N72-27228
Gas core reactor power transient analysis featuring high temperatures
[NASA-TM-X-68089] N72-27723
REACTOR MATERIALS
Irradiation effects on reactor structural materials, including stainless steels and iron alloys
[AD-739312] N72-27726
REACTOR SAFETY
Impact test of mobile nuclear reactor containment system
[NASA-TM-X-68103] N72-27721
RECOMBINATION REACTIONS
Electron generation and recombination processes in semiconductors
[AD-739978] N72-27809
RECORDING INSTRUMENTS
Instrument for recording position of center of gravity projection in horizontal plane
[AD-739439] N72-27136
RECURSIVE FUNCTIONS
Mathematical theory of predicting and controlling pulse processes in signed digraphs
[R-926-NSF] N72-27618
RED SHIFT
Application of atomic oscillators for direct measurement of effects of gravitation on time to verify equivalence principle
[NASA-CR-127429] N72-27363
REDUCTION [CHEMISTRY]
Reduction reactions and electrolytic separation of manganese dioxide in acid solution
[NLL-M-22291-[5828.4F]] N72-27141
REDUNDANT COMPONENTS
Reliability analysis of parallel standby system
[AD-739477] N72-27542
REENTRY PHYSICS
Change of shape in reentry bodies due to thermodynamic forces generated by high velocity movement in earth atmosphere
[JPRS-56424] N72-27003
Analysis of effect of high injection rates on laminar boundary layer and relation to atmospheric entry conditions
[JPRS-56437] N72-27322
REENTRY VEHICLES
Change of shape in reentry bodies due to thermodynamic forces generated by high velocity movement in earth atmosphere
[JPRS-56424] N72-27003
Characteristics of elliptically shaped leading edges of wings and fins for reduction of aerodynamic heating of reentry vehicles under hypervelocity flight conditions
[AD-739869] N72-27051
REFLECTANCE
Using remote sensors for controlled studies of reflectance and emittance characteristics of foliage on trees subjected to stresses
[NASA-CR-127420] N72-27375
REFLECTION
Technology and performance characteristics of directive diffuser for ultraviolet use N72-27465
REFLECTOMETERS
Precision measurements using colorimetry techniques to include spectrophotometry, reflectometry, metamerism, and tristimulus values - Vol. 9
[NBS-SP-300-VOL-9] N72-27524
REFLECTORS
Thin film vacuum deposition for optical surface finishing, noting dihedral deposition on reflector surface N72-27454
REFRACTIVITY
Approximate shock wave model for studying radial density distribution and refractive index in wake of shell in hypersonic flight
[ISL-16/71] N72-27323
REFRACTORY MATERIALS
Effects of hardness and microstructure of carbides of transition metals on abrasive wear resistance properties
[NLL-RTS-7289] N72-27513
REFRACTORY METALS
Inspection techniques for coated refractory metals and filamentary composites N72-27518
REGGE POLES
Fixed pole and Regge pole terms in formula for forward Compton scattering
[RIFP-148] N72-27760
REGRESSION ANALYSIS
Regression methods in five day mean height prediction at 500 mb using mean Nimbus 2 composited infrared data for identical periods in update procedure
[AD-739358] N72-27656
REINFORCED PLASTICS
Development of procedure for repairing fiberglass structures which retains geometry and strength of original structure
[NASA-CASE-LAR-10416-1] N72-27527
REINFORCEMENT [STRUCTURES]
Production, application, and properties of polycrystalline metal whiskers used with composite materials
[NLL-TRANS-746-1106-[9022.401]] N72-27555
REINFORCING FIBERS
Composite materials of nickel-chromium matrix and molybdenum-tungsten reinforcing fibers
[NLL-TRAS-746-1190-[9022.401]] N72-27597
RELATIVITY
Conservation laws and preferred frames in relativistic gravity
[NASA-CR-127277] N72-27358
Preferred-frame theories of gravity and extended parameterized post-Newtonian formalism N72-27359
Experimental evidence to rule out preferred-frame theories of gravity N72-27360
Effects of orbital perturbations on responses of gyroscope system for testing relativity theory in polar orbiting satellite
[AD-739500] N72-27712
RELAXATION [MECHANICS]
Relaxation profiles of ionizing shock wave in argon
[CP-36] N72-27772
RELIABILITY ENGINEERING
Switching circuits and relays for bus conductor reliability
[AD-739213] N72-27237
Code of practice for designing welded structures subjected to fatigue loading N72-27498
Advanced methods of reliability engineering and quality assurance for aerospace application
[NASA-TM-X-64666] N72-27516
Quality and reliability requirements for hybrid microcircuits in space flight applications N72-27520
Proceedings of conference on principles of strapdown inertial navigation platforms
[NASA-CR-123710] N72-27673
High temperature and humidity effects on plastic encapsulated semiconductors
[AD-739473] N72-27806
Analysis of structural failures occurring during NASA programs and recommendations to prevent or minimize similar failures in future programs
[NASA-TM-X-68850] N72-27946
REMOTE CONTROL
Biological and economic aspects and technological base of remotely manned systems
[P-4809] N72-27256
REMOTE SENSORS
Clustering technique for analyzing remote multispectral sensing data
[NASA-CR-123799] N72-27204
Biological and economic aspects and technological base of remotely manned systems
[P-4809] N72-27256
Remote sensing of Yellowstone National Park
[NASA-CR-127531] N72-27352
Remote sensing of flood damage in vicinity of Rapid City, South Dakota using color and infrared imagery
[SDSU-RSI-72-11] N72-27368
Using remote sensors for controlled studies of reflectance and emittance characteristics of foliage on trees subjected to stresses
[NASA-CR-127420] N72-27375
Development of remote sensing techniques in Europe
[SI-5] N72-27381
Annotated bibliography of remote sensing of air and water pollution for 1965 through 1970
[AD-737588] N72-27406
REQUIREMENTS
Analysis of military requirements and specifications for aircraft performance using F-5 aircraft
[AD-738625] N72-27039
Application of control system requirements to development of tactical missile weapon systems N72-27683
RESCUE OPERATIONS
Life support system for rescue crew in altitude chamber tests N72-27133
RESEARCH AND DEVELOPMENT
Japanese research and development progress in energy conversion and chemical propulsion
[AD-739325] N72-27067
Research in deep sea diving and lightning triggered by man N72-27099
Research and development in high temperature welded structures N72-27493
RESEARCH FACILITIES
Environmental impact statement for Marshall Space Flight Center Huntsville, Ala, and MTF in Hancock County Mississippi
[NASA-TM-X-68542] N72-27264
Environmental impact statement for Lewis Research Center Cleveland, Ohio
[NASA-TM-X-68557] N72-27266
Environmental impact statement for Jet Propulsion Laboratory at Pasadena, California
[NASA-CR-127575] N72-27267
Max-Planck-Institute Studies of Extraterrestrial Physics, noting barium cloud experiment
[MPI-PAE-EXTRATERR-59] N72-27896
Activities of National Center for Atmospheric Research during 1971 with emphasis on cooperation with other research organizations and activities
[AR-10] N72-27979
RESEARCH PROJECTS
Scientific and technical information systems and organizations in East Europe
[JPRS-56460] N72-27895
Summary of studies conducted to determine requirements for nonsurvivable space probe to explore atmosphere of planet Jupiter - Vol. I
[NASA-CR-122436] N72-27933
Supporting technical studies for design of nonsurvivable probe to explore atmosphere of planet Jupiter - Vol. 2
[NASA-CR-122439] N72-27934
Activities of National Center for Atmospheric Research during 1971 with emphasis on cooperation with other research organizations and activities
[AR-10] N72-27979
Scientific research projects on lasers, surveillance, armaments, materials and weapon analysis
[DREV-666/72] N72-27982
RESIDUAL STRESS
Approximate method for estimating residual stresses caused by longitudinal weld shrinkage N72-27500
RESISTANCE THERMOMETERS
Resistance thermometer coupled to data acquisition system for calorimeter temperature recording
[NLL-LIB-COMM-1656-[5196]] N72-27416
RESOLUTION
Optimization of image resolution by analog technique, compensating for aberration and diffraction defects N72-27470
RESPIRATION
Effects of bromotrifluoromethane inhalation and epinephrine challenge on cardiovascular system
[AD-739699] N72-27098
RESPIRATORY IMPEDANCE
Human tolerance to external respiratory resistance for design of breathing apparatus N72-27127
Control system analysis for mathematical modeling of respiratory protective devices N72-27128
RESPIRATORY RATE
Simulation and design of breathing metabolic simulator N72-27129
RETAINING
Development of composite structure for propeller blade retention on V/STOL aircraft propulsion system
[AD-739555] N72-27047
RETINA
Opthalmologic examinations for determining retina damage caused by helium-neon laser boresights
[AD-738629] N72-27087
RING CURRENTS
Stability of ring current protons beyond plasmapause for injection spectrum model
[NASA CR-122447] N72-27347

ROCKET ENGINE CONTROL
Rate gyro using asymmetrical rotor for rocket attitude control
[NAL-TR-259] N72-27429
ROCKET ENGINES
Vacuum chamber with scale model of rocket engine base area of space vehicle
[NASA-CASE-MFS-20620] N72-27262
ROCKET PROPELLED SLEDS
Wind barrier configuratons for rain erosion test section of rocket sled test track at Holloman AFB
[AD-739484] N72-27282
ROCKET SOUNDING
Triaxial piezoelectric accelerometer with sensitivity to extend upper limit of falling sphere type of upper atmospheric density measuring system
[AD-739202] N72-27473
Fe-group abundance in energetic solar particles measured by Nike-Apache payloads on 24 Jan. and 2 Sept. 1971 and 2 Sept. 1966
[NASA-TM-X-65919] N72-27833
RODS
Dynamic stability of rods connected by spring when subjected to periodic longitudinal loading and comparison with theoretical considerations
[NAL-TR-257] N72-27953
ROLLER BEARINGS
Thermal stress analysis on roller bearings in gas turbine compressor rotor
[AD-739209] N72-27537
Derivation of equation to predict rolling-element fatigue lives of through-hardened bearing steels combining effects of material hardness, carbide factor, and bearing temperature
[NASA-TM-X-68078] N72-27573
ROLLING MOMENTS
Least squares method for analyzing finned missile rolling at large angle of attack
[AD-739685] N72-27245
ROOTS OF EQUATIONS
Tables for root extrema of Wishart matrix
[AD-739518] N72-27626
ROTARY WING AIRCRAFT
Optimization techniques for estimating height-velocity diagram and critical decision point for rotorcraft based on impulsive response functions
[NAL-TR-245] N72-27026
ROTARY WINGS
Measurement of aerodynamic damping moment in pitch for hovering model helicopter rotary wing
[NAL-TR-256] N72-27028
Application of downwash from helicopter rotors for dissipation of fog
[AD-739487] N72-27042
Analysis of helicopter rotor wake patterns using water tunnel test facility
[AD-739946] N72-27052
ROTATING ENVIRONMENTS
Gravity simulation by rotation and effects on human performance
[NASA-CR-111866] N72-27104
ROTATING MIRRORS
Optical system for monitoring angular position of rotating mirror
[NASA-CASE-GSC-11353-1] N72-27736
ROTATING SHAFTS
Spiral groove seal for rotating shaft
[NASA-CASE-XLE-10326-4] N72-27522
ROTATING SPHERES
Collective oscillations of spherically symmetric systems of gravitational particles rotating in circular trajectories
[NASA-TT-F-14413] N72-27751
ROTORS
Rate gyro using asymmetrical rotor for rocket attitude control
[NAL-TR-259] N72-27429
RUBBER
Storage of compounded unvulcanized natural rubber mixes noting methods of examining changes
[ERDE-TR-44-PT-1] N72-27602
RUNWAY LIGHTS
Intensity control of condenser discharge light [flashers] for runway alignment indicator system
[FAA-RD-72-54] N72-27700
RUPTURING
Human eardrum rupture and hearing loss injuries from nuclear explosions
[AD-737643] N72-27092

S

SAFETY DEVICES
Aircraft accident investigations of crashes of agricultural aircraft and effectiveness of protective equipment in preventing injuries and fatalities
[FAA-AM-72-15] N72-27011
SAFETY MANAGEMENT
Industrial procedures and safety practices involved in commercial production and handling of oxygen
[NLL-CE-TRANS-5849-[9022.09]] N72-27487
SALINITY
Origin of saline soils and chemical migration
[TT-70-50169] N72-27400
SAMPLING
Asynchronous vocoder sampling and pulse coding of speech
[NASA-CR-127256] N72-27205
Objectives, payloads, sampling, and return for Phobos/Deimos mission
[NASA-CR-112077-3] N72-27878
SANDWICH STRUCTURES
Thermal conductivity of honeycomb sandwich panels for spacecraft structures
[NLR-TR-71031-U] N72-27967
SATELLITE ANTENNAS
Pattern analyses for paraboloid and elliptical antennas on synchronous satellites
[NASA-CR-112102] N72-27173
SATELLITE ATTITUDE CONTROL
Performance characteristics of thermopiles as infrared horizon scanners for satellite attitude control
N72-27439
Onboard solar sensors for French D2B satellite attitude control
N72-27458
Specifications for IR transhorizon scanner to control geostationary satellite attitude during transfer orbit passage
N72-27460
Specifications for onboard earth horizon scanner to control three axis stabilized Symphonie satellite
N72-27461
Attitude control and guidance mechanism for spacecraft and aircraft
[NASA-CR-127268] N72-27679
SATELLITE OBSERVATION
Satellite monitoring of open pit and strip mining operations
[BM-IC-8530] N72-27348
Electron spectra in inner radiation belt observed by Cosmos 219 satellite
[NASA-TT-F-14405] N72-27355
Explorer 33 magnetic field observations of sudden impulse propagation in geomagnetic tail and magnetosheath
[NASA-CR-127421] N72-27376
Use of geostationary satellite pictures for observation of tropical convective ensembles or cloud clusters
N72-27652
SATELLITE ORBITS
Horizontal gradients in ionospheric electron density and variations in Doppler frequency for satellite orbits
N72-27379
Measurements of upper-atmosphere rotational speed from changes in satellite orbits
[RAE-TR-71171] N72-27900
SATELLITE PERTURBATION
Preprocessing of Meteosat transmitted images, noting satellite rotation and displacement perturbation vs image geometry quality
N72-27469
SATELLITE TRACKING
Optical satellite tracking of Cosmos and other artificial satellites, Edinburgh, Feb. 1972
[ROE-STS-123] N72-27936
Optical satellite tracking of Cosmos and other artificial satellites, Edinburgh, Mar. 1972
[ROE-STS-124] N72-27937
SATELLITE TRANSMISSION
Criteria for optimizing communication satellite transmission efficiency, noting lower and higher frequency predicted scintillations
[REPT-6-71] N72-27188
SATELLITE-BORNE INSTRUMENTS
ATS pictures for meteorological applications and satellite-borne instruments
[NASA-CR-122437] N72-27646
SATELLITE-BORNE PHOTOGRAPHY
Technique for analyzing and forecasting tropical cyclone intensities by satellite pictures
[NOAA-TM-NESS-36] N72-27641
SATURN LAUNCH VEHICLES
Facilities and environmental measurements to be monitored in support of Apollo/Saturn vehicle AS-511
[NASA-TM-X-68517] N72-27261
SATURN 5 LAUNCH VEHICLES
Nuclear radiation effects on Saturn 5 materials and design of reusable nuclear shuttle
[NASA-CR-2045] N72-27717
Development of procedures for preparation of space vehicle and launch vehicle for subsequent launch following cancellation of prior attempt
[NASA-TM-X-68516] N72-27917
SCALE MODELS
Pitot pressure distributions of scale model of delta wing, space shuttle orbiter
[NASA-TM-X-62122] N72-27292
SCALING LAWS
Scale analysis with consideration of filtering and approximation of hydrothermodynamic equations for different meteorological scales
[NLL-M-22384-[5828.4F]] N72-27634
SCANNERS
Ultrasonic adjustable scanner for flaw detection in flat or radial panels of honeycomb structure with welded seams
[NASA-CASE-MFS-20335-1] N72-27421
SCATTERING CROSS SECTIONS
Incoherent scattering cross sections of turbulent boundary layer adjacent to conducting plane and cylindrical surfaces
[AD-738632] N72-27193
SCHMIDT CAMERAS
Performance characteristics of Kerber plate applied to spherical aberration correction of Schmidt astronomical telescope mirror
N72-27453
SCHROEDINGER EQUATION
Bound state Bethe-Salpeter equation
[TR-72-101] N72-27623
SCIENCE
Scientific and technical information systems and organizations in East Europe
[JPRS-56460] N72-27895
Statistical analysis of Federal obligations awarded to universities and colleges for academic science activities for fiscal year 1970
[NSF-72-301] N72-27978
SCIENTISTS
Transformation of scientists and engineers into managers
[NASA-SP-291] N72-27986
SCINTILLATION
Criteria for optimizing communication satellite transmission efficiency, noting lower and higher frequency predicted scintillations
[REPT-6-71] N72-27188
Ionospheric oscillation prediction technique for optimizing signal transmission of navigation satellite used as radio relay systems
[REPT-7-71] N72-27189
SCREWS
Adjustable support device with jacket screw for altering distance between base and supported member
[NASA-CASE-NPO-10721] N72-27484
SEA ICE
Passive microwave data and relative age of sea ice
[NOAA-TM-NESS-37] N72-27362
SEA OF JAPAN
Analysis of cold fronts in Sea of Japan
[NLL-M-22454-[5828.4F]] N72-27639
SEALS [STOPPERS]
Spiral groove seal for rotating shaft
[NASA-CASE-XLE-10326-4] N72-27522
SECONDARY EMISSION
Photoemission from polymers under irradiation by 15 to 25 keV photons
[AD-739498] N72-27610
SECONDARY INJECTION
Interaction between sonic two dimensional secondary injection jet and supersonic stream with axial pressure gradient
N72-27288
SEISMIC WAVES
Generalized linear filtering for averaging seismic transfer functions
[AD-739178] N72-27393
Noise reduction and signal to noise ratio for seismic arrays for twenty-four hour events
[AD-739181] N72-27394
Detection thresholds of seismic observatory
[AD-739173] N72-27397
Automatic data acquisition and processing for seismological station
[AD-739172] N72-27398
Deployment of vertical and horizontal broadband accelerometers to obtain seismic wave data
[AD-739975] N72-27481
SELENIDES
Pyromagnetic transition properties of cobalt-sulfur-selenium system
[AD-739336] N72-27798
SELENOLOGY
Origin of moon based on Apollo lunar samples
[NASA-TM-X-65924] N72-27886
SELF REPAIRING DEVICES
Monitoring circuitry design for self repairing computer
[AD-739417] N72-27224
SEMICONDUCTOR DEVICES
Solid state physics in microwave generation, microwave amplification, and semiconductors
[AD-739549] N72-27257
Solid state microwave oscillator and amplifier development
[AD-739543] N72-27259
Collisional broadening of Landau levels in polar semiconductor noting high order perturbation effects
N72-27795
Low field transport properties of polar semiconductors in parallel strong magnetic and weak electric fields, and computation of distribution functions
N72-27796
Low field transport properties of polar semiconductors in parallel magnetic and electric fields, noting distribution functions
N72-27797

Property data tables for group 2-6 compounds
[AD-739359] N72-27799
High temperature and humidity effects on plastic encapsulated semiconductors
[AD-739473] N72-27806
Lithium-drifted silicon detectors, fission cell, electron flux detectors, and semiconductor devices
[NASA-CR-127267] N72-27847
SEMICONDUCTORS [MATERIALS]
Integrated circuits and semiconductors for data processing systems
[AD-739548] N72-27258
Electroacoustic effects in III-V compound semiconductors
[RR-725] N72-27791
Comparison of Lorentz number calculations in semiconductors
[AD-739245] N72-27802
Czochralski technique for improving growth and characterization of GaAs and mixed III and V semiconductor crystals
[AD-739374] N72-27807
Electron generation and recombination processes in semiconductors
[AD-739978] N72-27809
Optical, thermal, and magnetic properties of group 2-6 compounds and related semiconductors over wide temperature range including very low temperatures
[AD-739867] N72-27810
SENSITIVITY
Sensitivity changes in neutron detectors in intense gamma fields
[NLL-WH-TRANS-324-[9091.9F]] N72-27418
SENSORIMOTOR PERFORMANCE
Effects of noise and illumination on human motor performance
[AD-739474] N72-27095
Reliability of complex tracking task performed concurrently with other tasks or tracking alone condition
[FAA-AM-72-21] N72-27105
SENSORY PERCEPTION
Stimulus durations and individual differences approach for monitoring performance across sense modes
[AD-737735] N72-27089
Response time to vibrotactile stimulus in relation to signal amplitude and frequency variation
[AD-739433] N72-27139
SENSORY STIMULATION
Response time to vibrotactile stimulus in relation to signal amplitude and frequency variation
[AD-739433] N72-27139
SEPARATED FLOW
Separated flow point determination on blown flap airfoil of STOL wing propulsion system N72-27286
SEPARATORS
Operational efficiency of countercurrent continuous gas chromatograph with enlarged processing column
[NLL-RTS-6992] N72-27407
SEQUENTIAL ANALYSIS
Sequential tests for radar target recognition with multiple range elements
[REPT-177] N72-27187
SERVICE LIFE
Life tests on crossed field amplifiers
[AD-738458] N72-27236
Repair times and maintenance life cycle cost comparison between transistors and tubes
[AD-739476] N72-27239
Computer programs to predict friction torque and service life of series-hybrid bearing assembly
[NASA-TM-X-68093] N72-27528
Surface properties and service life of metastable austenite
[NLL-TRANS-746-1100-[9022.401]] N72-27556
SERVICES
Analysis of condition of service and manufacturing technology in US and recommendations for stimulating advancement
[P-4806] N72-27983
SERVOMECHANISMS
Disturbance absorbing controllers for servomechanism problems
[AD-739503] N72-27260
SHADOWS
Evaluation of model shadow shield thermal protection system and support members for possible application to shielding of cryogenic tanks to reduce heat transfer
[NASA-TM-X-68099] N72-27966
SHEAR STRESS
Development of optimal control theory and application to mass design of simply supported shear plate with fixed fundamental frequency of vibration
[NASA-CR-2044] N72-27945
SHELLS [STRUCTURAL FORMS]
Approximate shock wave model for studying radial density distribution and refractive index in wake of shell in hypersonic flight
[ISL-16/71] N72-27323
Numerical analyses of large amplitude vibrations of thin elastic plates and shallow shells under random excitation and limiting boundary conditions
[AD-739976] N72-27958
SHELTERS
Design of auxiliary survival shelter as portable life support system in mines N72-27115
SHOCK DISCONTINUITY
Numerical analysis of viscous gas flow and shock formation N72-27300
SHOCK TUBES
Shock tube hypersonic gas flow measurements using helium-neon laser differential interferometer
[ISL-14/71] N72-27324
SHOCK WAVES
Computation of one dimensional shocked flow N72-27301
Computation of transonic inviscid flow with imbedded shock waves N72-27306
Shock wave oscillation in unsteady axisymmetric supersonic flow as model of earth bow shock
[ESRO-SN-113] N72-27383
Ion acoustic solitary waves and shocks in two-component argon plasma
[NASA-CR-127387] N72-27770
Precursor electron and ion densities ahead of ionizing shock waves
[CP-31] N72-27775
Electrostatic singularity in magnetic mirror field in collisionless plasma noting shock formation
[TRITA-EPP-72-10] N72-27777
SHORT TAKEOFF AIRCRAFT
Change in aircraft congestion due to introduction of STOL aircraft into airport operation N72-27007
Analysis of noise generated by target type thrust reversers used on augmentor-wing short takeoff aircraft
[NASA-TM-X-68082] N72-27012
Analysis of peak axial-velocity decay in moving airstream for several nozzles and effect on noise generated by short takeoff aircraft with externally blown flaps
[NASA-TM-X-68102] N72-27029
Measurement of aircraft noise generated by YOV-10A short takeoff aircraft and comparison with wind tunnel data
[NASA-TM-X-62166] N72-27031
Six degree of freedom simulator tests to determine effects of motion cues on short takeoff and landing aircraft approach
[NASA-CR-114458] N72-27032
Separated flow point determination on blown flap airfoil of STOL wing propulsion system N72-27286
Determination of upwash angles for short takeoff aircraft lifting system using two dimensional potential flow analysis
[NASA-TM-X-2593] N72-27817
SHRINKAGE
Approximate method for estimating residual stresses caused by longitudinal weld shrinkage N72-27500
SHROUDS
Response of shroud-enclosed spacecraft to combined acoustic-vacuum environments
[NASA-TM-X-65922] N72-27734
Acoustic vibratory response of structural OGO model enclosed in shroud and without shroud
[NASA-TM-X-65921] N72-27735
SHUTTERS
High speed electrically actuated ribbon loop for shuttering optical or fluid passageways
[NASA-CASE-ARC-10516-1] N72-27739
SIDELOBES
Computerized simulation of radar sidelobe clutter reduction by pulse compression
[AD-739512] N72-27195
SIGNAL GENERATORS
Audio frequency analysis circuit for determining, displaying, and recording frequency of sweeping audio frequency signal
[NASA-CASE-NPO-11147] N72-27408
SIGNAL PROCESSING
Interactive graphics for structural languages and biological waveform analysis, using special purpose computers
[AD-739258] N72-27135
Fluid amplifier circuit for control of fluidic input signal
[NASA-CASE-LAR-10868-1] N72-27232
SIGNAL RECEPTION
Ground based reception of Cosmos-381 satellite signals from magnetically conjugate domain N72-27180
Filter for third order phase locked loops used in signal receivers
[NASA-CASE-NPO-11941-1] N72-27249
SIGNAL TO NOISE RATIOS
Noise reduction and signal to noise ratio for seismic arrays for twenty-four hour events
[AD-739181] N72-27394
SIGNAL TRANSMISSION
Baseline communications channel model for studying low bit rate telemetry transmissions from Explorer satellites
[NASA-CR-122435] N72-27168
Ground based reception of Cosmos-381 satellite signals from magnetically conjugate domain N72-27180
Time-axis-compression multiplex transmission and analysis of compression signals and waveforms
[REPT-18] N72-27203
Data storage system with vidicon tube for electrical input/output signal processing
[NASA-CASE-MSC-14053-1] N72-27215
SILICON
Silicon solar cells for low solar intensity and low temperature applications, including manufacturing procedure
[NASA-CR-114475] N72-27065
Part specification solar cells, silicon N-ON-P solderless low temperature operation for Jupiter missions
[NASA-CR-114476] N72-27066
Properties of silicon and silicon nitride and physiological effects on rats
[NLL-RTS-7103] N72-27594
Boron atom diffusion in silicon coatings
[PUBL-884] N72-27600
SILICON CARBIDES
Measured output of germanium photovoltaic cell with erbium oxide and silicon carbide radiators
[AD-739489] N72-27072
Thermal stability of aluminum oxide whiskers in silicon-aluminum alloy matrix
[AD-736973] N72-27608
Possible use of beta-silicon carbide as photocell material
[AD-739223] N72-27803
SILICON NITRIDES
Properties of silicon and silicon nitride and physiological effects on rats
[NLL-RTS-7103] N72-27594
SIMULATORS
Simulation of dynamic spin of F-4 aircraft under pilot control using human centrifuge facility
[AD-739326] N72-27278
SINGLE CRYSTALS
Growth of single crystals of mixed titanates and tungstates
[NASA-CR-120949] N72-27792
Effect of gamma irradiation on first constant of magnetic crystallographic anisotropy of single crystals of nickel and nickel copper ferrites
[AD-739286] N72-27805
SINGULARITY [MATHEMATICS]
Electrostatic singularity in magnetic mirror field in collisionless plasma noting shock formation
[TRITA-EPP-72-10] N72-27777
SIZE [DIMENSIONS]
Dimensions of anti-corona electrodes for high voltage test equipment
[NLL-CE-TRANS-5794-[9022.09]] N72-27247
SIZE SEPARATION
Methods, procedures, and equipment for isolation of submicron particles from agglomerate matrix
[AD-739197] N72-27162
SKYLAB PROGRAM
Modified Apollo portable life support system for Skylab astronauts N72-27117
Development of manual navigation sightings for evaluating performance of Skylab corollary experiments
[NASA-CR-61386-APP-O] N72-27680
Environmental impact statement for Skylab program
[NASA-TM-X-68553] N72-27905
Consolidated instrumentation plan to monitor performance and trajectory of Skylab 1 and Skylab 2
[NASA-TM-X-68520] N72-27918
Functional performance analyses on Skylab foot controlled maneuvering unit
[NASA-CR-61386-APP-R] N72-27920
SLIDING FRICTION
Testing cast iron-hardened steel friction pairs
[AD-739278] N72-27534
SLOPES
Water and heat balance effects on moisture content of slope soils
[NLL-M-22458-[5828.4F]] N72-27344
SMOG
Ethylene chemiluminescence ozone detector for smog chamber studies
[BM-RI-7650] N72-27420
SNAP 9A
Global fallout measurements of Pu-238 from SNAP-9A burnup
[HASL-250] N72-27724
SNOW COVER
Airborne gamma surveys for determining water equivalent of snow cover
[TT-70-50093] N72-27662
SODIUM
Active transport of Na and K ions and reaction mechanism for ATP-ase
[NLL-RTS-6898] N72-27075

SODIUM COOLING
High integrity tube-to-tubeplate bore welds for sodium cooled fast reactor
N72-27505

SOIL SCIENCE
Water and heat balance effects on moisture content of slope soils
[NLL-M-22458-[5828.4F]] N72-27344

SOILS
Origin of saline soils and chemical migration
[TT-70-50169] N72-27400

SOLAR ACTIVITY
Microdensitometric film reduction, analysis, and display techniques applied to solar surface radiance and stellar spectral data
[AD-739868] N72-27482
Satellite and ground observations of solar phenomena, meteorology, and interplanetary matter
N72-27893

SOLAR ACTIVITY EFFECTS
Effects of solar constant change on earth climate
[NLL-M-22455-[5828.4F]] N72-27830

SOLAR ARRAYS
Electrical interconnection of unilluminated solar cells in solar battery array
[NASA-CASE-GSC-10344-1] N72-27053

SOLAR ATMOSPHERE
Solar abundance of iron and damping constant
N72-27843

SOLAR CELLS
Electrical interconnection of unilluminated solar cells in solar battery array
[NASA-CASE-GSC-10344-1] N72-27053
Technical feasibility of improving efficiency of solar cells for space programs
[NASA-CR-127234] N72-27055
Considerations, conclusions, and recommendations for improving efficiency of solar cells
N72-27056
Physical processes underlying solar-energy conversion through photovoltaic effect
N72-27057
Analysis of loss mechanisms in silicon solar cells and their impact on conversion efficiency
N72-27059
Silicon solar cells for low solar intensity and low temperature applications, including manufacturing procedure
[NASA-CR-114475] N72-27065
Part specification solar cells, silicon N-ON-P solderless low temperature operation for Jupiter missions
[NASA-CR-114476] N72-27066

SOLAR CONSTANT
Effects of solar constant change on earth climate
[NLL-M-22455-[5828.4F]] N72-27830

SOLAR CORPUSCULAR RADIATION
Fe-group abundance in energetic solar particles measured by Nike-Apache payloads on 24 Jan. and 2 Sept. 1971 and 2 Sept. 1966
[NASA-TM-X-65919] N72-27833

SOLAR CYCLES
Solar cycle effects on excess radiation intensity at low altitudes
N72-27839

SOLAR ENERGY
Physical processes underlying solar-energy conversion through photovoltaic effect
N72-27057
Maximum efficiency of solar energy conversion for photovoltaic cells
N72-27058

SOLAR FLARES
Solar flare protons and physical processes affecting particle propagation in interplanetary space
N72-27829
Fe-group abundance in energetic solar particles measured by Nike-Apache payloads on 24 Jan. and 2 Sept. 1971 and 2 Sept. 1966
[NASA-TM-X-65919] N72-27833

SOLAR MAGNETIC FIELD
Variations in interplanetary magnetic field polarity and solar magnetic cycle
[NASA-CR-127422] N72-27370
Outwardly directed solar magnetic fields and their origin
[NASA-CR-127423] N72-27834

SOLAR PROTONS
Solar flare protons and physical processes affecting particle propagation in interplanetary space
N72-27829
Solar proton intensity vs time and angular distribution of intensity in interplanetary space near earth
[NASA-CR-127425] N72-27835
Relationship of 19 GHz solar radio bursts to solar proton emission
[AD-738287] N72-27840

SOLAR RADIATION
Ionospheric and solar radiation data, Greece - Aug. 1971
N72-27836
Ionospheric propagation and solar radiation data, Greece - July 1971
N72-27837

SOLAR RADIO EMISSION
Relationship of 19 GHz solar radio bursts to solar proton emission
[AD-738287] N72-27840

SOLAR SENSORS
Design and performance of electro-optical solar orientation and navigation instruments
N72-27433
Onboard solar sensors for French D2B satellite attitude control
N72-27458

SOLAR SPECTROMETERS
Specifications of multichannel solar spectrometer onboard OSO-1, noting experimental design
N72-27457

SOLAR WIND
Gas proportional counter for solar wind ions, H and He ions of interstellar origin, and faint optical emission lines for interstellar gas
[NASA-CR-127274] N72-27831
Upper limits of electron and proton fluxes in Jupiter radiation belts, using radial diffusion for getting solar wind fluxes into inner regions of belts
N72-27868

SOLDERS
Reaction kinetics and microstructure resulting from interaction of Ni coating and Sn-Pb solder
[NLL-TRANS-746-1155-[9022.401]]
N72-27566

SOLID PROPELLANT ROCKET ENGINES
Design of stand for thrust vector control experiments with solid propellant rocket engines
[RPE-TR-71/4] N72-27277
Technical data supplement for solid rocket motor of space shuttle booster
[NASA-CR-127416] N72-27821
Test firing of Thiokol TE-T-607-1 engine at simulated altitude conditions
[AD-739191] N72-27828

SOLID ROCKET BINDERS
High heating rate, thermoanalytical technique for studying condensed phase reactions of binder fuels and ammonium perchlorate based, propellant-like materials
N72-27813

SOLID ROCKET PROPELLANTS
Fracturing in solid rocket propellants
[AD-739355] N72-27812
High heating rate, thermoanalytical technique for studying condensed phase reactions of binder fuels and ammonium perchlorate based, propellant-like materials
N72-27813

SOLID SOLUTIONS
Diffusion scattering of X rays by solid U-Mo solution
[AD-739226] N72-27587

SOLID STATE DEVICES
Conference papers on solid state physics
[AD-739691] N72-27808

SOLID STATE LASERS
Theoretical and experimental analysis of mode filters for single frequency Nd YAG lasers and wideband electro-optic modulators
[AD-738489] N72-27552

SOLID STATE PHYSICS
Solid state physics in microwave generation, microwave amplification, and semiconductors
[AD-739549] N72-27257

SOLIDIFIED GASES
Tables on properties of liquid hydrogen at low temperature
[TT-70-50179] N72-27745

SOLUBILITY
Solubility and diffusion in titanium-aluminum-hydrogen systems, and degasification due to titanium
[NLL-294-[8660.5]] N72-27570

SONAR
On-axis, far field, difference frequency pressure generated in high amplitude, primary sound field
[AD-739321] N72-27740

SONIC BOOMS
Compilation of technical reports on theoretical aerodynamics, aircraft performance, sonic booms, aircraft stability, and turbulent boundary layers - Vol. 2
[SBN-11-470152-0] N72-26994

SOOT
Analysis of confined laminar flames with emphasis on parameters which determine flame geometry and emission of soot
[NLL-T-1530-[9022.305]] N72-27960

SOUND WAVES
Multisensor arrays for long period acoustic gravity waves in atmosphere
[AD-739260] N72-27387
Sound ray theory for analyzing effects of horizontal gradients on acoustic wave propagation velocity in channels
N72-27727

SOUNDING ROCKETS
Environmental impact statement for physics and astronomy sounding rocket, balloon, and airborne research programs
[NASA-TM-X-68556] N72-27909

SOUTH DAKOTA
Remote sensing of flood damage in vicinity of Rapid City, South Dakota using color and infrared imagery
[SDSU-RSI-72-11] N72-27368

SPACE ENVIRONMENT SIMULATION
Results of studies on microorganisms with direct bearing on space biology
[NASA-TT-F-14307] N72-27081
Onboard optical system degradation prediction by space environment simulation
N72-27456

SPACE EXPLORATION
Aeronautical history leading to American space exploration
[PUBL-70-10] N72-27980

SPACE FLIGHT
Soviet bloc research in astronomy, meteorology, oceanography, geology, and space science - 30 June 1972
[JPRS-56398] N72-27884
Soviet bloc resea ch in astronomy, meteorology, oceanography, geology, and space science - 7 July 1972
[JPRS-56444] N72-27890

SPACE LABORATORIES
Design, development, and characteristics of modular space station for use with space shuttle system
[NASA-CR-123719] N72-27912

SPACE MISSIONS
Development of manual navigation sightings for evaluating performance of Skylab corollary experiments
[NASA-CR-61386-APP-O] N72-27680
Environmental impact statement for Skylab program
[NASA-TM-X-68553] N72-27905
Design, development, and characteristics of research and applications module for use with space shuttle system
[NASA-CR-123733] N72-27919
Agreement between US and USSR for cooperative space missions and compatibility of spacecraft components
N72-27972

SPACE NAVIGATION
Characteristics of strapdown inertial platforms using redundant two degree of freedom gyros
N72-27676
Development of manual navigation sightings for evaluating performance of Skylab corollary experiments
[NASA-CR-61386-APP-O] N72-27680

SPACE SHUTTLE BOOSTERS
Wind tunnel tests to determine pressure distribution on space shuttle booster in abort configuration at Mach 3 - Vol. 3
[NASA-CR-120062] N72-27927
Wind tunnel tests to determine pressure distribution on space shuttle booster in abort configuration at Mach 2 - Vol. 5
[NASA-CR-120064] N72-27929

SPACE SHUTTLE ORBITERS
Pitot pressure distributions of scale model of delta wing, space shuttle orbiter
[NASA-TM-X-62122] N72-27292
Wind tunnel tests to determine static longitudinal and lateral-directional aerodynamic effects of various configuration changes on parametric delta wing orbiter
[NASA-CR-123722] N72-27923
Wind tunnel tests to determine abort separation pressures on space shuttle orbiter at Mach 5 - Vol. 2 Pt B
[NASA-CR-120061] N72-27926
Wind tunnel tests to determine pressure distribution on space shuttle orbiter in abort configuration at Mach 3 - Vol. 4
[NASA-CR-120063] N72-27928
Wind tunnel tests to determine pressure distribution on space shuttle orbiter in abort configuration at Mach 2 - Vol. 6
[NASA-CR-120065] N72-27930
Wind tunnel tests for heat transfer distributions on LMSC 040C and 040A-L4 Delta wing space shuttle orbiter
[NASA-CR-120072] N72-27935

SPACE SHUTTLES
Design, analysis, and performance of space shuttle auxiliary power systems
[NASA-CR-1995] N72-27054
Analysis of selected supporting systems for use with auxiliary power unit for space shuttle - Vol. 4
[NASA-CR-1996] N72-27064
Nuclear heating effects on propellant and structures of reusable nuclear shuttle configuration
[NASA-CR-2042] N72-27718
Technical data supplement for solid rocket motor of space shuttle booster
[NASA-CR-127416] N72-27821
Environmental impact statement of space shuttle program
[NASA-TM-X-68541] N72-27910
Establishment of criteria for design of onboard monitoring and checkout equipment for use with space shuttle propulsion system - Vol. 1
[NASA-CR-123712] N72-27911

Large space program cost savings from low cost, refurbishable, and standard spacecraft
[NASA-CR-127117] N72-27913
Mission analysis and preliminary shuttle/payload constraints analysis
[NASA-CR-127118] N72-27914
Flight test program to determine aerodynamic characteristics and performance of space shuttle vehicles in horizontal takeoff flight
[NASA-TM-X-68515] N72-27915
Design, development, and characteristics of research and applications module for use with space shuttle system
[NASA-CR-123733] N72-27919
Labor costs and techniques for maintenance of thermal protection system for space shuttle applications
[NASA-CR-112034-1] N72-27922
Wind tunnel tests to determine pressure distribution of space shuttle abort stage under various conditions of Mach number, Reynolds number, and angles of attack - Vol. 1, Pt. A
[NASA-CR-120008-VOL-1-PT-A] N72-27924
Wind tunnel tests to determine pressure distribution on space shuttle scale model in abort mode configuration under various aerodynamic conditions - Vol. 1 Pt. B
[NASA-CR-120008-VOL-1-PT-B] N72-27925

SPACE STATIONS
Design, development, and characteristics of modular space station for use with space shuttle system
[NASA-CR-123719] N72-27912

SPACE SUITS
Automatic controller of liquid cooled space suit using human sweat rate as input signal N72-27125

SPACEBORNE PHOTOGRAPHY
Updating maps of transportation networks by space photography
[NASA-CR-127530] N72-27422

SPACECRAFT
Vacuum chamber with scale model of rocket engine base area of space vehicle
[NASA-CASE-MFS-20620] N72-27262

SPACECRAFT COMMUNICATION
Systems analysis of analog and digital voice coding techniques for use with satellite based air traffic control system
[NASA-CR-122432] N72-27701

SPACECRAFT COMPONENTS
Radio telemetry for spacecraft N72-27883

SPACECRAFT CONFIGURATIONS
Response of shroud-enclosed spacecraft to combined acoustic-vacuum environments
[NASA-TM-X-65922] N72-27734

SPACECRAFT DESIGN
Design fluences for electrons and protons and damage effects from low energy electrons and protons for spacecraft in Jupiter radiation belts N72-27856
Jupiter radiation environmental impact on TOPS 12L design N72-27859
Design, development, and characteristics of modular space station for use with space shuttle system
[NASA-CR-123719] N72-27912
Design, development, and characteristics of research and applications module for use with space shuttle system
[NASA-CR-123733] N72-27919
Design of Lunokhod-1, including two television systems
[AD-738683] N72-27938

SPACECRAFT DOCKING
Docking manned spacecraft and radio telemetry
[JPRS-56464] N72-27881
Simulation and training for spacecraft docking N72-27882

SPACECRAFT ELECTRONIC EQUIPMENT
Radiation effects of electrons and protons trapped in Jupiter radiation belts on scientific instruments and electronic components N72-27858

SPACECRAFT ENVIRONMENTS
Method for determining magnetic moment of spacecraft from magnetic field data obtained in limited region close to spacecraft
[NASA-TN-D-6685] N72-27732

SPACECRAFT GUIDANCE
Attitude control and guidance mechanism for spacecraft and aircraft
[NASA-CR-127268] N72-27679
Development and numerical analysis of three-dimensional optimal explicit guidance system for space vehicles
[NAL-TR-258] N72-27931

SPACECRAFT INSTRUMENTS
Radiation effects of electrons and protons trapped in Jupiter radiation belts on scientific instruments and electronic components N72-27858
Geiger-Mueller tube epxeriment package for Pioneers F and G to study energetic electrons and protons in Jupiter magnetosphere N72-27871
Pioneers F and G experiments of gating energetic charged particle detectors, plasma analyzer, and magnetometer for assessing Jupiter radiation belts N72-27872

SPACECRAFT LAUNCHING
Spacecraft launched 1958 - 1971 noting mass, size, shape, orbit, launch data and time
[RAE-TR-72004] N72-27898
Environmental impact statement of Apollo project based on ten Apollo spacecraft and Saturn 5 launch vehicle operations at Cape Kennedy Launch Complex, Florida
[NASA-TM-X-68544] N72-27903
Environmental impact statement of Nimbus satellite program
[NASA-TM-X-68554] N72-27908

SPACECRAFT MODELS
Development of technique for launching aerodynamic models at hypersonic speed using helium-operated light gas gun facility
[CP-34] N72-27275

SPACECRAFT MODULES
Design, development, and characteristics of research and applications module for use with space shuttle system
[NASA-CR-123733] N72-27919

SPACECRAFT MOTION
Motion of nutation damper on spin-stabilized axisymmetric spacecraft
[NAL-TR-251] N72-27892

SPACECRAFT ORBITS
Spacecraft launched 1958 - 1971 noting mass, size, shape, orbit, launch data and time
[RAE-TR-72004] N72-27898

SPACECRAFT PERFORMANCE
Flight test program to determine aerodynamic characteristics and performance of space shuttle vehicles in horizontal takeoff flight
[NASA-TM-X-68515] N72-27915
Consolidated instrumentation plan to monitor performance and trajectory of Skylab 1 and Skylab 2
[NASA-TM-X-68520] N72-27918

SPACECRAFT POWER SUPPLIES
Technical feasibility of improving efficiency of solar cells for space programs
[NASA-CR-127234] N72-27055
Considerations, conclusions, and recommendations for improving efficiency of solar cells N72-27056

SPACECRAFT PROPULSION
Establishment of criteria for design of onboard monitoring and checkout equipment for use with space shuttle propulsion system - Vol. 1
[NASA-CR-123712] N72-27911

SPACECRAFT STABILITY
Flight test program to determine aerodynamic characteristics and performance of space shuttle vehicles in horizontal takeoff flight
[NASA-TM-X-68515] N72-27915

SPACECRAFT STRUCTURES
Thermal conductivity of honeycomb sandwich panels for spacecraft structures
[NLR-TR-71031-U] N72-27967

SPACECRAFT TRACKING
Tracking thrust-maneuvering space vehicle based on noise measurement N72-27844

SPACECRAFT TRAJECTORIES
Consolidated instrumentation plan to monitor performance and trajectory of Skylab 1 and Skylab 2
[NASA-TM-X-68520] N72-27918

SPARK CHAMBERS
Quantitative values of luminance and radiance from high density nanosecond spark channels
[AD-739253] N72-27741

SPECTROMETERS
Ultraminiature X ray fluorescence spectrometer for determining element composition data
[NASA-CR-127526] N72-27846

SPECTROPHOTOMETRY
Precision measurements using colorimetry techniques to include spectrophotometry, reflectometry, metamerism, and tristimulus values - Vol. 9
[NBS-SP-300-VOL-9] N72-27524

SPECTROSCOPIC ANALYSIS
Auger spectroscopy for detecting polytetrafluoroethylene adhesion on metal surfaces in ultrahigh vacuum
[NASA-TM-X-68076] N72-27150

SPECTRUM ANALYSIS
Inclusive and exclusive multiparticle spectra for simple models of high energy hadronic interactions
[ILL-[TH]-72-7] N72-27758

SPEECH
Asynchronous vocoder sampling and pulse coding of speech
[NASA-CR-127256] N72-27205

SPEECH RECOGNITION
Binaurally time delayed signal generator for improved speech intelligibility
[AD-738628] N72-27192
Computer recognition of speech signals
[JPRS-56370] N72-27210

SPHERES
Modulated force probe for drag coefficient measurements of spheres in hypersonic noncontinuum flow
[AD-739250] N72-27327

SPIN TESTS
Simulation of dynamic spin of F-4 aircraft under pilot control using human centrifuge facility
[AD-739326] N72-27278

SPIN-LATTICE RELAXATION
Influence of relaxation processes on Mossbauer measurements of superparamagnetic alpha-FeOOH and alpha-Fe2O3 crystallites N72-27793

SPORES
Thermal activation and relative humidity effects on spore pregermination
[NASA-CR-127525] N72-27077

SPRINGS [ELASTIC]
Dynamic stability of rods connected by spring when subjected to periodic longitudinal loading and comparison with theoretical considerations
[NAL-TR-257] N72-27953

STABILIZATION
Electro-optical stabilization of calibrated light source
[NASA-CASE-MSC-12293-1] N72-27411

STAGNATION POINT
Electron energy along stagnation point streamline ahead of blunt body in nonequilibrium, partially ionized gas at supersonic speed
[CP-35] N72-27319

STAINLESS STEELS
Structural diagram for evaluating class and structural state of stainless steels
[NLL-TRANS-746-1176-[9022.401]] N72-27569
Irradiation effects on reactor structural materials, including stainless steels and iron alloys
[AD-739312] N72-27726

STANDARDS
Empirical data and variance-covariance matrix for 1969 Smithsonian Standard Earth [2]
[NASA-CR-127269] N72-27361
Proceedings of conference on weights and measures conducted by National Bureau of Standards in July 1971
[NBS-SP-358] N72-27975

STAPHYLOCOCCUS
Viability of staphylococci isolated from humans subjected to long term isolation in pressurized cabins
[NLL-RTS-7117] N72-27074

STAR TRACKERS
Microelectronic integrated circuits for control of Canopus tracker
[NASA-CR-127418] N72-27251
Onboard star tracker with coded pointing system for Meteosat attitude control N72-27459

STARS
Microdensitometric film reduction, analysis, and display techniques applied to solar surface radiance and stellar spectral data
[AD-739868] N72-27482

STATIC ELECTRICITY
Static electrification, bonding, grounding, and lightning protection techniques applied to aircraft, spacecraft, and missiles
[AD-739356] N72-27037

STATIC FRICTION
Vibration frequency effect on coefficient of static friction
[AD-739279] N72-27535

STATISTICAL ANALYSIS
Statistical analysis of XB-70 aircraft responses and control inputs
[NASA-TN-D-6872] N72-27013
Statistical analysis of flight time, takeoff and landing weight, fuel weight at takeoff and landing for transport jet aircraft
[TB-88] N72-27035
Statistical computation of linking strategies for multiple radar surveillance using Markov chains
[REPT-130] N72-27181
Statistical analysis of ground and weather clutter data on magnetic digital tape recordings
[REPT-165] N72-27185
Statistical analysis of radar target and clutter data on magnetic digital tape recordings
[REPT-175] N72-27186
Statistical analysis of frequency distribution in mineral oil pipeline pressure variations
[FB-93] N72-27325
Empirical data and variance-covariance matrix for 1969 Smithsonian Standard Earth [2]
[NASA-CR-127269] N72-27361
Statistics and environmental causes of amplitude modulation near ocean surface
[AD-739357] N72-27388
Statistical analysis of Federal obligations awarded to universities and colleges for academic science activities for fiscal year 1970
[NSF-72-301] N72-27978

STATISTICAL TESTS
Sequential tests for radar target recognition with multiple range elements
[REPT-177] N72-27187

STATORS
Performance and distortion tolerance of 1500 ft/sec tip speed transonic fan stage with variable geometry inlet guide vanes and variable stagger stator
[NASA-CR-72880] N72-27818

STEELS
Deep-drawing and stretch forming behavior of steel in shaping large cylindrical cups
[NLL-TRANS-746-1152-[9022.401]] N72-27483
Design codes which determine quality and overall cost of pressure vessels constructed in carbon and carbon-manganese steel N72-27492
Hydrogen embrittlement and carbide disintegration of metals used in pressure vessels N72-27494
Toughness of heat-affected zone of stress-relieved, automatic submerged-arc, pressure vessel seam weld in steels N72-27496
Improved design of welded LD vessels used in steel production N72-27508
Quenching after hot deformation for improved mechanical properties of steels
[PB-207425] N72-27545
Uniform elongation and work hardening of sheet and spherical aluminum and copper alloys, brass, and steel
[NLL-TRANS-746-1121-[9022.401]] N72-27557
Selection of intermediate layer material for application to production of corrosion-resistant bimetal
[NLL-TRANS-746-1147-[9022.401]] N72-27559
Relation between creep rupture strength and electron microstructure of Cr-Mo steels after heat treatment
[NLL-CE-TRANS-5594-[9022.09]] N72-27560
Effects of cerium additions on ductility, brittle fracture, and strength of low alloy normalized steels
[NLL-T-518-[9022.305]] N72-27565
Wear resistance of chrome vanadium steels and dependence on distribution of alloying elements in martensite and carbides
[AD-739276] N72-27581
Strain rate and elevated temperature effects on mechanical properties of Cr-Mo-V steels
[AD-739516] N72-27591
Empirical equations for calculating heating and cooling effects on thermal and physical properties of steel
[NLL-M-21368-[5828.4F]] N72-27962

STELLAR GRAVITATION
Nonspherical perturbations of relativistic gravitational field in collapsing star N72-27841

STELLAR MOTIONS
Proper motions of 1357 faint stars - catalog
[NASA-CR-127264] N72-27849

STEREOSCOPIC VISION
Stereoscopic television system, including projecting pair of binocular images
[NASA-CASE-ARC-10160-1] N72-27728

STOCHASTIC PROCESSES
Limit theorems, Markov processes, additive functionals, and potential theory
[AD-739983] N72-27629

STORAGE STABILITY
Storage of compounded unvulcanized natural rubber mixes noting methods of examining changes
[ERDE-TR-44-PT-1] N72-27602

STRAIN GAGES
Automatic capacitance measurement system
[AD-739556] N72-27480

STRAIN RATE
Empirical equation describing flow stress and strain rates of metals at high temperatures during extrusion
[NLL-LTI-746-1181-[9022.401]] N72-27571
Strain rate and elevated temperature effects on mechanical properties of Cr-Mo-V steels
[AD-739516] N72-27591

STRAPDOWN INERTIAL GUIDANCE
Proceedings of conference on principles of strapdown inertial navigation platforms
[NASA-CR-123710] N72-27673
Analysis principles of strapdown inertial platforms with emphasis on rebalance loop electronics and attitude algorithms N72-27674
Analysis of rebalance loop in strapdown inertial platform to show pulse shape, dc bias, and sampling process N72-27675
Characteristics of strapdown inertial platforms using redundant two degree of freedom gyros N72-27676
Application of attitude transformation algorithms for strapdown inertial platforms and realization by digital differential analyzers N72-27677
Analysis and comparison of two types of strapdown gyroscope rebalance electronic systems in terms of accuracy and resolution N72-27678

STRATIFIED FLOW
Convection and mixing of stratified fluid in rotating container for Apollo spacecraft
[NASA-TR-R-386] N72-27313

STRATUS CLOUDS
Droplet size and concentration, and liquid water content of altostratus, altocumulus, and middle level accessory clouds
[TN-43] N72-27644

STRESS ANALYSIS
Criteria for optimum design of welded structures to withstand dynamic service stresses N72-27510
Analysis of stress and strain concentration factors under static tensile load in elasto-plastic region
[NAL-TR-279] N72-27950
Analysis of stress intensity factor of half-plane crack extending non-uniformly in isotopic elastic solid subjected to general loading
[AD-739557] N72-27957

STRESS MEASUREMENT
Photoelastic measurement of stresses on axial flow compressor disc with numerous pin hole perforations
[NAL-TR-274] N72-27948

STRESS RELAXATION
Stress-relaxation tests of ferritic iron samples to determine plastic deformation processes occurring in stressed material due to thermal energy
[NLL-TRANS-746-1168-[9022.401]] N72-27942

STRESS RELIEVING
Toughness of heat-affected zone of stress-relieved, automatic submerged-arc, pressure vessel seam weld in steels N72-27496

STRESS-STRAIN DIAGRAMS
Fracture and stress-strain behavior of ATJ-S graphite under uniaxial, biaxial, and triaxial stresses
[AD-739204] N72-27604

STRESSES
Empirical equation describing flow stress and strain rates of metals at high temperatures during extrusion
[NLL-LTI-746-1181-[9022.401]] N72-27571

STRUCTURAL ANALYSIS
Development of techniques to improve aerodynamic stability of suspension bridges and reduce effects of wind loads
[NLL-M-22432-[5828.4F]] N72-27944
Development of optimal control theory and application to mass design of simply supported shear plate with fixed fundamental frequency of vibration
[NASA-CR-2044] N72-27945
Vibration analysis of three parallel beams with different rigidities based on Rayleigh-Ritz method with three approximated deflection functions
[NAL-TR-271] N72-27949

STRUCTURAL DESIGN
Simulation and design of breathing metabolic simulator N72-27129
Design and performance of electro-optical solar orientation and navigation instruments N72-27433
Radar altimeter design for high altitude balloon flights N72-27650

STRUCTURAL DESIGN CRITERIA
Selection criteria for capacitive transducer for distance measurement
[NASA-CR-127250] N72-27434
Specifications and performance of mechanical scanning infrared radiometer for earth cloud cover onboard Meteosat N72-27467

STRUCTURAL FAILURE
Analysis of structural failures occurring during NASA programs and recommendations to prevent or minimize similar failures in future programs
[NASA-TM-X-68850] N72-27946

STRUCTURAL STABILITY
Development of techniques to improve aerodynamic stability of suspension bridges and reduce effects of wind loads
[NLL-M-22432-[5828.4F]] N72-27944

SUBCRITICAL FLOW
Computer program for airfoil pressure distribution for subcritical viscous attached flow
[NAL-TR-248] N72-27317

SUBMARINE CABLES
Development of procedure to prevent or arrest corrosion in communication cables buried in soil or underwater at Kennedy Space Center
[KSC-TM4-275-MI] N72-27916

SUBSONIC FLOW
Numerical analysis of inviscid gas flow due to accelerating cylinder and computation of steady subsonic flow N72-27302

SUBSONIC SPEED
Subsonic, two dimensional wall interference effect in perforated transonic wind tunnel
[NAL-TR-252T] N72-27318

SUBZERO TEMPERATURE
Inflatable, thermally insulative emergency survival suit for subzero weather N72-27132

SUCTION
Method for calculating lowest suction rate to prevent laminar boundary layer separation of semibonded stream
[AD-739222] N72-27330

SULFIDES
Pyromagnetic transition properties of cobalt-sulfur-selenium system
[AD-739336] N72-27798

SUPERCONDUCTING MAGNETS
Indirect heat conduction cooling of superconducting Ni-Ti stabilized magnet coils
[DESY-71/57] N72-27794

SUPERCONDUCTIVITY
Properties of superconducting materials and bibliography
[NBS-TN-724] N72-27790

SUPERHETERODYNE RECEIVERS
VHF correlation radio interferometer consisting of two superheterodyne receivers for investigating ionospheric disturbances by receiving signals from ATS satellites
[NASA-CR-127270] N72-27345

SUPERHIGH FREQUENCIES
Microwave power amplifier and processing system for superhigh frequency transmission by Communications Technology Satellite
[NASA-TM-X-68106] N72-27177
Construction and operation of superhigh frequency transmitter and receiver installation for color television system
[REPT-150] N72-27269

SUPERSONIC AIRCRAFT
Wind tunnel models for determining inlet interference and performance of inlet/airframe combination in supersonic aircraft design N72-27019

SUPERSONIC COMBUSTION RAMJET ENGINES
Supersonic mixing and combustion of coaxial hydrogen-air streams in duct
[AD-739866] N72-27971

SUPERSONIC COMMERCIAL AIR TRANSPORT
Effects of upper atmosphere turbulence on operation of supersonic transport aircraft and methods for advance detection of atmospheric turbulence
[NLL-M-22437-[5828.4F]] N72-27009
Analysis of terminal area flight procedures and air routes for supersonic transport aircraft on transatlantic flights from Kennedy International Airport, New York
[NASA-TN-D-6801] N72-27010
Factors affecting optimum flight routes for supersonic transport aircraft operation
[NLL-M-22436-[5828.4F]] N72-27672

SUPERSONIC FLOW
Resistance of pyramidal shaped bodies in supersonic flow
[AD-739293] N72-27333
Shock wave oscillation in unsteady axisymmetric supersonic flow as model of earth bow shock
[ESRO-SN-113] N72-27383

SUPERSONIC WIND TUNNELS
Hypersonic wind tunnel tests on delta wing models at high incidence for pressure distribution determination
[ARC-CP-1198] N72-27004

SUPPORT SYSTEMS
Adjustable support device with jacket screw for altering distance between base and supported member
[NASA-CASE-NPO-10721] N72-27484

SUPPORTS
Design of stand for thrust vector control experiments with solid propellant rocket engines
[RPE-TR-71/4] N72-27277
Fixture for supporting articles during vibration tests comprising integral annular unit
[NASA-CASE-MFS-20523] N72-27412

SURFACE FINISHING
Langmuir probe surface contamination noting plasma jet simulation, decontamination methods, and material selection
[ESRO-SN-115-ESTEC] N72-27531
Effect of diamond burnishing on quality of chromium coatings
[AD-739206] N72-27607

SURFACE GEOMETRY
Potential step and triangular voltage sweep methods in surface capacitance measurements on porous silver electrodes
[AD-739482] N72-27242

SURFACE PROPERTIES
Surface properties and service life of metastable austenite
[NLL-TRANS-746-1100-[9022.401]] N72-27556
Thermoelastic processes in surface layer of wear resistant metals subjected to abrasive wear
[AD-739277] N72-27582
Compressive stress effects on surface hardness of glazes
[NLL-T-1509-[9022.305]] N72-27595
Effect of diamond burnishing on quality of chromium coatings
[AD-739206] N72-27607
SURFACE WAVES
Stacking fault effects on bounded ultrasonic surface waves in liquid-solid interface
[AD-739703] N72-27748
SURVEILLANCE RADAR
Statistical computation of linking strategies for multiple radar surveillance using Markov chains
[REPT-130] N72-27181
SURVIVAL
Analysis of survival following crashes of military aircraft and identification of areas for improvement in structural design
[AD-739370] N72-27044
SURVIVAL EQUIPMENT
Conference on portable life support systems for human protection
[NASA-SP-302] N72-27106
Inflatable, thermally insulative emergency survival suit for subzero weather N72-27132
SWEAT
Automatic controller of liquid cooled space suit using human sweat rate as input signal N72-27125
SWITCHING CIRCUITS
Ten-ampere switching transistor for use in traveling wave current supply and main control unit of telecommunication system in communications satellite
[NASA-TT-F-14338] N72-27229
Switching circuits and relays for bus conductor reliability
[AD-739213] N72-27237
SYNCHRONOUS SATELLITES
Pattern analyses for paraboloid and elliptical antennas on synchronous satellites
[NASA-CR-112102] N72-27173
SYNOPTIC METEOROLOGY
Daily height and temperature analysis of constant pressure levels for Northern Hemisphere
[QR-1-PT-1] N72-27633
Scale analysis with consideration of filtering and approximation of hydrothermodynamic equations for different meteorological scales
[NLL-M-22384-[5828.4F]] N72-27634
Analysis of cold fronts in Sea of Japan
[NLL-M-22454-[5828.4F]] N72-27639
SYSTEMS ANALYSIS
Design, analysis, and performance of space shuttle auxiliary power systems
[NASA-CR-1995] N72-27054
Hybrid computers and digital simulation languages for continuous system dynamics analysis
[NASA-CR-127252] N72-27220
Systems analysis of analog and digital voice coding techniques for use with satellite based air traffic control system
[NASA-CR-122432] N72-27701
SYSTEMS ENGINEERING
Design, development, and evaluation of three-axis hydrofluidic stability augmentation system for UH-1 helicopter
[AD-739559] N72-27045
Design, analysis, and performance of space shuttle auxiliary power systems
[NASA-CR-1995] N72-27054
Analysis of selected supporting systems for use with auxiliary power unit for space shuttle - Vol. 4
[NASA-CR-1996] N72-27064
Performance, construction, and applications of sealed nickel cadmium batteries
[AD-739211] N72-27068
Analysis of secondary power system for use with advanced rotary wing aircraft for reliable production of electric power
[AD-739480] N72-27069
Bioelectric system for control of muscular activity
[NRC-TT-1551] N72-27083
Design of gas mixture breathing systems for underwater diver equipment N72-27108
Design of command and control systems using decision and information theory
[AD-739708] N72-27201
Construction, calibration, and operation of Bunsen-type ice calorimeter
[AD-739186] N72-27475
Construction of liquid laser system to produce high energy pulses
[AD-739715] N72-27554
Optimizing linear system against quadratic cost function and application to guidance and control system for tactical missiles N72-27685
Design and performance tests of 5-cm diameter ion thruster
[NASA-TM-X-68110] N72-27825
Design of flight control system for launch vehicle models of geostationary satellite
[NAL-TR-264] N72-27932

T

TABLES [DATA]
Magnetic observation tables for Resolute, Northwest Territories
[M70-43/5] N72-27339
Ionospheric sounding data for 1971 from Monte Capellino Observatory, Italy N72-27380
Tables on properties of liquid hydrogen at low temperature
[TT-70-50179] N72-27745
Property data tables for group 2-6 compounds
[AD-739359] N72-27799
Technical data supplement for solid rocket motor of space shuttle booster
[NASA-CR-127416] N72-27821
TAKEOFF RUNS
Change in aircraft congestion due to introduction of STOL aircraft into airport operation N72-27007
TANKS [CONTAINERS]
Convection and mixing of stratified fluid in rotating container for Apollo spacecraft
[NASA-TR-R-386] N72-27313
TARGET ACQUISITION
Application of microwave guidance sensors for tracking and fire control systems used in missile attack on small tactical targets N72-27693
TARGET RECOGNITION
Sequential tests for radar target recognition with multiple range elements
[REPT-177] N72-27187
TASK COMPLEXITY
Effect of noise and temperature on human performance of simple manual dexterity task
[AD-739432] N72-27097
Reliability of complex tracking task performed concurrently with other tasks or tracking alone condition
[FAA-AM-72-21] N72-27105
TECHNICAL WRITING
Schedule of meetings and lectures for 1973 technical program of Advisory Group for Aerospace Research and Development
[AGARD-BULL-72-2] N72-27976
TECHNOLOGIES
Scientific and technical information systems and organizations in East Europe
[JPRS-56460] N72-27895
TECHNOLOGY ASSESSMENT
Development of deep sea diving technology N72-27100
Analysis of condition of service and manufacturing technology in US and recommendations for stimulating advancement
[P-4806] N72-27983
Application of technologies developed by NASA programs for solution of problems in urban communities
[NASA-CR-127417] N72-27985
TECHNOLOGY TRANSFER
Application of technologies developed by NASA programs for solution of problems in urban communities
[NASA-CR-127417] N72-27985
TECHNOLOGY UTILIZATION
Cryogenic and liquid metal technology applications in industry and for ground transportation
[NASA-TM-X-68092] N72-27737
Analysis of condition of service and manufacturing technology in US and recommendations for stimulating advancement
[P-4806] N72-27983
Application of technologies developed by NASA programs for solution of problems in urban communities
[NASA-CR-127417] N72-27985
TELECOMMUNICATION
Ten-ampere switching transistor for use in traveling wave current supply and main control unit of telecommunication system in communications satellite
[NASA-TT-F-14338] N72-27229
TELEMETRY
Baseline communications channel model for studying low bit rate telemetry transmissions from Explorer satellites
[NASA-CR-122435] N72-27168
Low cost telemetry subcarrier oscillator for high acceleration applications
[AD-739481] N72-27194
TELESCOPES
Design and development of light sensing device for controlling orientation of object relative to sun or other light source
[NASA-CASE-NPO-11201] N72-27409
TELEVISION SYSTEMS
Stereoscopic television system, including projecting pair of binocular images
[NASA-CASE-ARC-10160-1] N72-27728
TEMPERATURE CONTROL
Automatic controller of liquid cooled space suit using human sweat rate as input signal N72-27125
Evaluation of model shadow shield thermal protection system and support members for possible application to shielding of cryogenic tanks to reduce heat transfer
[NASA-TM-X-68099] N72-27966
TEMPERATURE DISTRIBUTION
Steady state and transient temperature distributions in human thigh covered with cooling pad
[NASA-CR-127523] N72-27084
Sea surface temperature distribution for Atlantic Ocean and Mediterranean Sea
[NLL-M-22342-[5828.4F]] N72-27338
Relationship between turbulence coefficient and temperature and wind distribution in lower boundary layer
[AD-739221] N72-27658
Method for determining gas temperature profile and decay, using temperature dependence of line absorption
[AD-739491] N72-27783
TEMPERATURE EFFECTS
Effect of noise and temperature on human performance of simple manual dexterity task
[AD-739432] N72-27097
Empirical equations for calculating heating and cooling effects on thermal and physical properties of steel
[NLL-M-21368-[5828.4F]] N72-27962
TEMPERATURE INVERSIONS
Relation between amount and depth of radiation inversions at night and diurnal range of air temperature at 2-m height in different USSR regions
[NLL-M-22336-[5828.4F]] N72-27630
TEMPERATURE MEASUREMENT
Internal plasticization of aromatic polyesters by side chain alkylation noting 5 alkyl resorcinol isophtalate polymer glass transition temperature measurements
[RAE-TR-71223] N72-27158
Development of thermocouple instrument for measuring temperature of wall heated by flowing fluid without disturbing boundary layer
[NASA-CASE-XLE-05230] N72-27410
Resistance thermometer coupled to data acquisition system for calorimeter temperature recording
[NLL-LIB-COMM-1656-[5196]] N72-27416
Development and evaluation of fluidic turbine inlet gas temperature sensors
[NAL-TR-265] N72-27428
TEMPERATURE SENSORS
Using kryptonates as passive temperature sensors
[AD-739372] N72-27478
TEMPLATES
Precision surface cutter for screen circuit negatives and other microcircuits
[NASA-CASE-XLA-09843] N72-27485
TENSILE PROPERTIES
Microstructure and mechanical and tensile properties of thermomechanically processed titanium alloys
[AD-739365] N72-27589
TENSILE STRENGTH
Analysis of stress and strain concentration factors under static tensile load in elasto-plastic region
[NAL-TR-279] N72-27950
TENSILE TESTS
Development of test apparatus for subjecting metal specimen to tensile and compressive loads at constant temperature
[NASA-CASE-LAR-10426-1] N72-27947
Analysis of stress and strain concentration factors under static tensile load in elasto-plastic region
[NAL-TR-279] N72-27950
TERMINAL FACILITIES
Analysis of terminal area flight procedures and air routes for supersonic transport aircraft on transatlantic flights from Kennedy International Airport, New York
[NASA-TN-D-6801] N72-27010
Transportation planning for airports and other intercity terminals
[PB-207529] N72-27280
Characteristics and operation of air trafic control radar system installed at USSR airports
[JPRS-56463] N72-27705
TERMINAL GUIDANCE
Characteristics of electro-optical terminal guidance systems, area correlators, and gated trackers used for guidance and control of tactical missiles N72-27688
Inertial guidance techniques for midcourse guidance and terminal guidance systems with application to control and guidance of tactical standoff missiles N72-27691

Characteristics of command-to-line-of-sight guidance and semi-active homing missile systems applied to guidance and control of tactical missiles N72-27692
Application of microwave guidance sensors for tracking and fire control systems used in missile attack on small tactical targets N72-27693

TERMINAL VELOCITY
Ice crystal terminal velocities for calculating ice crystal growth in clouds, evaporation in subcloud regions, and precipitation rates
[NASA-CR-127428] N72-27645

TERRAIN ANALYSIS
Clustering technique for analyzing remote multispectral sensing data
[NASA-CR-123799] N72-27204

TESSERAL HARMONICS
Analysis of 15th-order geopotential coefficients obtained from orbit of Transit 1B
[RAE-TR-72003] N72-27899

TEST EQUIPMENT
Dimensions of anti-corona electrodes for high voltage test equipment
[NLL-CE-TRANS-5794-(9022.09)] N72-27247
Development and characteristics of apparatus for measuring intensity of electric field in atmosphere
[NASA-CASE-KSC-10730-1] N72-27431
Development of test apparatus for subjecting metal specimen to tensile and compressive loads at constant temperature
[NASA-CASE-LAR-10426-1] N72-27947
Development of apparatus for detonating explosive devices in order to determine forces generated and detonation propagation rate
[NASA-CASE-LAR-10800-1] N72-27959

TEST FACILITIES
Axisymmetric nozzle for producing test section flow in hypersonic test facility
[NASA-TM-X-64664] N72-27273
Metallurgical test facilities for ESRO satellites noting techniques and equipment
[ESRO-TM-153-ESTEC] N72-27276
Design, development, and fabrication of total inflight simulator facility
[AD-739230] N72-27279
Wind barrier configuratons for rain erosion test section of rocket sled test track at Holloman AFB
[AD-739484] N72-27282
Hydrospace simulator facility for testing material properties at sea depths to 1000 FSW
[AD-739695] N72-27283
Comparing visual and auditory displays when used as dynamic tri-level condition displays for electronic checkout
[AD-739475] N72-27477

TEST FIRING
Test firing of Thiokol TE-T-607-1 engine at simulated altitude conditions
[AD-739191] N72-27828

TESTS
Friction coefficent determination for plastic steel slide bearings
[AD-739212] N72-27538

TF-30 ENGINE
Afterburning steady state performance and operational limits of TF-30 turbofan engine
[NASA-TN-D-6839] N72-27014
Inlet random pressure fluctuation effects on turbojet engine stall characteristics N72-27022

THEMIS PROJECT
Methods for determining electromagnetic characteristics of severe thunderstorms-Themis weather project
[AD-739544] N72-27668

THERMAL BUCKLING
Thermal deformation effects on bond integrity and causing of failure modes N72-27521

THERMAL CONDUCTIVITY
Thermal conductivity of neon, krypton, xenon, and vapors of alkali metals with dissociation calculation and thermophysical properties of gases
[AD-738737] N72-27161
Thermal conductivity of chiatura manganese concentrates and their pelletized products in temperature range of 100 to 900 C
[AD-739215] N72-27585
Comparison of Lorentz number calculations in semiconductors
[AD-739245] N72-27802
Numerical solution of thermal conductivity for hollow cylinders by application of Green functions
[NLL-WH-TRANS-325-(9091.9F)] N72-27963
Thermal conductivity of honeycomb sandwich panels for spacecraft structures
[NLR-TR-71031-U] N72-27967

THERMAL DEGRADATION
Carbonization and thermal transformations of carbo- and hetero-chain polymers
[NLL-RTS-7032] N72-27142

THERMAL EMISSION
Calorimeter for measuring thermal output of nickel cadmium batteries
[NASA-CASE-GSC-11434-1] N72-27430
Distribution of linearly polarized lunar thermal emission at wavelength of 3.1 mm
[NASA-CR-127273] N72-27848

THERMAL ENVIRONMENTS
Thermal activation and relative humidity effects on spore pregermination
[NASA-CR-127525] N72-27077

THERMAL EXPANSION
X ray photography used to obtain thermal expansion data for nickel-chromium alloys
[AD-739301] N72-27588

THERMAL INSULATION
Diving suit and heat element combinations for thermal protection of underwater divers N72-27120
Performance of liquid cooled garment system inside pressure suit of pilot N72-27121

THERMAL PROTECTION
Carbon dioxide- and thermal-control in regenerative life support system for extravehicular human protection during advanced space missions N72-27114
Labor costs and techniques for maintenance of thermal protection system for space shuttle applications
[NASA-CR-112034-1] N72-27922

THERMAL SHOCK
Fracture mechanics approach to thermal shock resistance of brittle materials
[AD-739494] N72-27609

THERMAL STABILITY
Synthesis of alpha, omega bis [hydroxy dimethyl silyl phenyl] perfluoro alkane thermally stable elastomer
[RAE-TR-71224] N72-27159
Long term stability of Nichrome based heat resistant composite, reinforced with tungsten fibers
[NLL-TRANS-746-1148-(9022.401)] N72-27596
Thermal stability of aluminum oxide whiskers in silicon-aluminum alloy matrix
[AD-736973] N72-27608
Empirical equations for calculating heating and cooling effects on thermal and physical properties of steel
[NLL-M-21368-(5828.4F)] N72-27962

THERMAL STRESSES
Thermal stress analysis on roller bearings in gas turbine compressor rotor
[AD-739209] N72-27537

THERMIONIC CONVERTERS
Reactor heated in-core diodes for energy conversion
[NASA-CASE-NPO-10542] N72-27228
Tungsten-rhenium electrode performance in cesium thermionic converters
[NASA-TM-X-68091] N72-27722

THERMIONIC DIODES
Reactor heated in-core diodes for energy conversion
[NASA-CASE-NPO-10542] N72-27228

THERMISTORS
Performance and specifications of thermistor bolometers for sensing horizon for attitude control N72-27437

THERMOCOUPLES
Development of thermocouple instrument for measuring temperature of wall heated by flowing fluid without disturbing boundary layer
[NASA-CASE-XLE-05230] N72-27410
Series connected thermocouples for temperature measuring device in atmospheric turbulence studies
[NLA-TR-260] N72-27427
Calibration of thermocouples at melting point of platinum by small batch method
[AD-738748] N72-27474

THERMODYNAMIC EFFICIENCY
Cold air performance of single stage axial flow turbine
[NAL-TR-273] N72-27822

THERMODYNAMIC PROPERTIES
Numerical solution of thermal conductivity for hollow cylinders by application of Green functions
[NLL-WH-TRANS-325-(9091.9F)] N72-27963

THERMODYNAMICS
Thermal conductivity of neon, krypton, xenon, and vapors of alkali metals with dissociation calculation and thermophysical properties of gases
[AD-738737] N72-27161
Heat balance equations for studying diurnal heat budget of thermosphere
[NASA-TM-X-65928] N72-27364
Thermodynamics of electron beam metal welding with dagger fusion
[AD-739289] N72-27533
Scale analysis with consideration of filtering and approximation of hydrothermodynamic equations for different meteorological scales
[NLL-M-22384-(5828.4F)] N72-27634
Solving equations of hydrothermodynamics for weather forecasting
[AD-739239] N72-27657

THERMOELASTICITY
Thermoelastic processes in surface layer of wear resistant metals subjected to abrasive wear
[AD-739277] N72-27582

THERMOPHYSICAL PROPERTIES
Property data tables for group 2-6 compounds
[AD-739359] N72-27799
Optical, thermal, and magnetic properties of group 2-6 compounds and related semiconductors over wide temperature range including very low temperatures
[AD-739867] N72-27810

THERMOPILES
Performance characteristics of thermopiles as infrared horizon scanners for satellite attitude control N72-27439

THERMOREGULATION
Neck cooling collar for improved thermal comfort in hot weather N72-27126
Simulation and design of breathing metabolic simulator N72-27129
Inflatable, thermally insulative emergency survival suit for subzero weather N72-27132
Evaluation of model shadow shield thermal protection system and support members for possible application to shielding of cryogenic tanks to reduce heat transfer
[NASA-TM-X-68099] N72-27966

THERMOSETTING RESINS
Fluorinated polyurethanes produced by reacting hydroxy terminated perfluoro polyether with diisocyanate
[NASA-CASE-NPO-10767-2] N72-27151

THERMOSPHERE
Tables of interpolation constants for calculation of transmittance and rate of dissociation of molecular oxygen in mesosphere and lower thermosphere
[NASA-TM-X-58084] N72-27349
Heat balance equations for studying diurnal heat budget of thermosphere
[NASA-TM-X-65928] N72-27364
Neutral composition measurements of mesosphere and lower thermosphere
[AD-739169] N72-27664

THIGH
Steady state and transient temperature distributions in human thigh covered with cooling pad
[NASA-CR-127523] N72-27084

THIN FILMS
Thin film vacuum deposition for optical surface finishing, noting dihedral deposition on reflector surface N72-27454
Thin absorbing metallic film for increased visible light transmission
[NASA-CASE-LAR-10836-1] N72-27784
Magnetostrictive coefficients of thin nickel films and irreversible resistivity transformations
[NLL-LTI-746-1160-(9022.401)] N72-27785
Magnetostrictive properties of thin nickel films and effect of magnetic state
[NLL-LTI-746-1159-(9022.401)] N72-27786
Increased resistivity of thin metallic films caused by gas adsorption
[NLL-TRANS-746-1194-(9022.401)] N72-27789

THIN PLATES
Performance characteristics of Kerber plate applied to spherical aberration correction of Schmidt astronomical telescope mirror N72-27453

THIN WALLS
Heat exchanger tube-to-tubeplate welded joints for thin walled tubes N72-27506

THIOLS
Gas chromatographic analysis of alcohols and mercaptans
[NASA-TT-F-14348] N72-27153

THREE DIMENSIONAL FLOW
Numerical analysis of response of spherical balloon to atmospheric turbulence and three-dimensional time-dependent flows
[NASA-TN-D-6829] N72-27001
Numerical analysis of three dimensional ideal gas flow and Euler equations of motion N72-27307
Two dimensional solutions for three dimensional velocity calculation on turbomachine centrifugal impeller flow
[NASA-TM-X-67959] N72-27720

THRESHOLD GATES
Metal-nitride-silicon variable threshold transistors as storage elements
[NASA-CR-127276] N72-27250

THRESHOLDS
Detection thresholds of seismic observatory
[AD-739173] N72-27397

THRUST
Determination of thrust and drag characteristics for integrated aircraft engine design optimization N72-27023

THRUST VECTOR CONTROL
Design of stand for thrust vector control experiments with solid propellant rocket engines
[RPE-TR-71/4] N72-27277
Thruster attitude control simulation for designing and evaluating reaction control system
[NASA-TM-X-64660] N72-27815
THUNDERSTORMS
Lightning triggered by man and lightning hazards N72-27101
Time lapse cloud brightness data from ATS 3 and correlation of cirrus shield variations in time to rainfall rate in midlatitude storm complexes N72-27648
Methods for determining electromagnetic characteristics of severe thunderstorms-Themis weather project
[AD-739544] N72-27668
THYROID GLAND
Existence of hypocalcemic factor in human thyroids
[NASA-TT-F-14341] N72-27079
TIME CONSTANT
Binary coding of continuous time communications
[NASA-TT-F-13896] N72-27207
Synthesis of feedback systems with large plant ignorance for prescribed time domain tolerances
[NASA-CR-116779] N72-27253
Feasibility of neglecting small time constants of control systems of uniaxial gyrostabilizer N72-27697
TIME DEPENDENCE
Repair times and maintenance life cycle cost comparison between transistors and tubes
[AD-739476] N72-27239
TIME MEASUREMENT
Application of atomic oscillators for direct measurement of effects of gravitation on time to verify equivalence principle
[NASA-CR-127429] N72-27363
Precision measurement techniques applied to frequency and time standards and time synchronizations - Vol. 5
[NBS-SP-300-VOL-5] N72-27523
TIME OF FLIGHT SPECTROMETERS
Monoenergetic charged particle beam studies, using time of flight spectrometers
[AD-739189] N72-27827
TIME SIGNALS
Precision measurement techniques applied to frequency and time standards and time synchronizations - Vol. 5
[NBS-SP-300-VOL-5] N72-27523
TIN ALLOYS
Nickel-tin alloy deposition with hydrazine hydrate
[NLL-TRANS-746-1196-[9022.401]] N72-27572
TIROS SATELLITES
Environmental impact statement for TIROS program
[NASA-TM-X-68551] N72-27907
TITANATES
Growth of single crystals of mixed titanates and tungstates
[NASA-CR-120949] N72-27792
TITANIUM
Solubility and diffusion in titanium-aluminum-hydrogen systems, and degasification due to titanium
[NLL-294-[8660.5]] N72-27570
TITANIUM ALLOYS
Vacuum device used for plotting isothermal diagrams of titanium alloys by X ray diffraction method
[AD-739219] N72-27586
Microstructure and mechanical and tensile properties of thermomechanically processed titanium alloys
[AD-739365] N72-27589
Hydrogen-dislocation interactions in alpha titanium aluminum alloys studied via internal friction measurements at high temperatures
[AD-739696] N72-27593
TOPS [SPACECRAFT]
Jupiter radiation environmental impact on TOPS 12L design N72-27859
TOUGHNESS
Toughness of heat-affected zone of stress-relieved, automatic submerged-arc, pressure vessel seam weld in steels N72-27496
TOXIC HAZARDS
Cholinesterase methods for assaying pesticide poisoning in blood of aerial applicator personnel
[FAA-AM-72-12] N72-27080
TRACE ELEMENTS
Gas chromatography and chelation for metal trace determinations in water and human body
[AD-739865] N72-27166
TRACKING [POSITION]
Reliability of complex tracking task performed concurrently with other tasks or tracking alone condition
[FAA-AM-72-21] N72-27105
TRACKING RADAR
Design of electronically controlled tracking radar system with phased arrays
[REPT-162] N72-27183
Electronically controlled radar tracking with Kalman filtering
[REPT-173] N72-27184
TRACTION
Analysis of elastohydrodynamic properties of advanced engine lubricants with determination of traction coefficients and film thickness
[AD-739390] N72-27546
TRAINING DEVICES
Design, development, and fabrication of total in-flight simulator facility
[AD-739230] N72-27279
TRAJECTORIES
Real world geopotential model with low orbit trajectories
[AD-739492] N72-27940
TRAJECTORY MEASUREMENT
Trajectory computations in FORTRAN for engineering-type application, using differential equations
[NASA-TM-X-64679] N72-27891
TRANSDUCERS
Surveys of capacitive transducers and their circuit design
[NASA-CR-127251] N72-27235
Selection criteria for capacitive transducer for distance measurement
[NASA-CR-127250] N72-27434
TRANSFER FUNCTIONS
Procedures for evaluating effect of transfer function zeros on transient response of aircraft and determining desirable regions of pole-zero locations
[NASA-TM-X-2585] N72-27024
Importance of advanced information given to pilots considered as element in automatic control system
[REPT-64] N72-27034
Generalized linear filtering for averaging seismic transfer functions
[AD-739178] N72-27393
Technique for estimating modulation transfer function of imaging system from edge response
[AD-739550] N72-27479
TRANSISTOR AMPLIFIERS
Cascade coupling of microwave bipolar transistors forming broadband amplifier
[PB-207377] N72-27241
TRANSISTORS
Ten-ampere switching transistor for use in traveling wave current supply and main control unit of telecommunication system in communications satellite
[NASA-TT-F-14338] N72-27229
Repair times and maintenance life cycle cost comparison between transistors and tubes
[AD-739476] N72-27239
Metal-nitride-silicon variable threshold transistors as storage elements
[NASA-CR-127276] N72-27250
TRANSIT 1B SATELLITE
Analysis of 15th-order geopotential coefficients obtained from orbit of Transit 1B
[RAE-TR-72003] N72-27899
TRANSITION POINTS
Extent of transition zone and heat transfer during mixed flow of air in pipes
[AD-739210] N72-27328
TRANSITION TEMPERATURE
Synthesis of alpha, omega bis [hydroxy dimethyl silyl phenyl] perfluoro alkane thermally stable elastomer
[RAE-TR-71224] N72-27159
TRANSMISSION EFFICIENCY
Research and development of bandpass filters for 2 to 20 micron range, noting transmission efficiency N72-27447
TRANSMITTANCE
Tables of interpolation constants for calculation of transmittance and rate of dissociation of molecular oxygen in mesosphere and lower thermosphere
[NASA-TM-X-58084] N72-27349
TRANSMITTERS
Design of transmitter traveling wave tube for communication satellite
[AD-739542] N72-27244
TRANSONIC COMPRESSORS
Performance and distortion tolerance of 1500 ft/sec tip speed transonic fan stage with variable geometry inlet guide vanes and variable stagger stator
[NASA-CR-72880] N72-27818
TRANSONIC FLOW
Computation of transonic inviscid flow with imbedded shock waves N72-27306
TRANSONIC SPEED
Economic analysis of transport aircraft operating in transonic region with consideration of materials, aerodynamic configuration, and cruise speed
[NASA-TM-X-62159] N72-27015
TRANSONIC WIND TUNNELS
Subsonic, two dimensional wall interference effect in perforated transonic wind tunnel
[NAL-TR-252T] N72-27318
Transonic wind tunnel calibration of dual system gust measuring probe
[ARL/A-NOTE-334] N72-27426
TRANSPORT AIRCRAFT
Economic analysis of transport aircraft operating in transonic region with consideration of materials, aerodynamic configuration, and cruise speed
[NASA-TM-X-62159] N72-27015
Statistical analysis of flight time, takeoff and landing weight, fuel weight at takeoff and landing for transport jet aircraft
[TB-88] N72-27035
Investigation of electrical fire on Vickers Viscount transport aircraft at Honolulu International Airport, Hawaii, 8 August, 1971
[PB-207902] N72-27049
TRANSPORT PROPERTIES
Active transport of Na and K ions and reaction mechanism for ATP-ase
[NLL-RTS-6898] N72-27075
Low field transport properties of polar semiconductors in parallel strong magnetic and weak electric fields, and computation of distribution functions N72-27796
Low field transport properties of polar semiconductors in parallel magnetic and electric fields, noting distribution functions N72-27797
TRANSPORTATION
Transportation planning for airports and other intercity terminals
[PB-207529] N72-27280
TRAPPED PARTICLES
Location, density, and energy of energetic protons in Jupiter radiation belts N72-27865
Pitch-angle diffusion and stably trapped limits for protons in Earth and Jupiter magnetospheres N72-27867
TRAPS
Injection of fast molecular ions into trap
[NASA-TT-F-14339] N72-27750
TRAVELING WAVE TUBES
Ten-ampere switching transistor for use in traveling wave current supply and main control unit of telecommunication system in communications satellite
[NASA-TT-F-14338] N72-27229
Design of transmitter traveling wave tube for communication satellite
[AD-739542] N72-27244
TREES [PLANTS]
Using remote sensors for controlled studies of reflectance and emittance characteristics of foliage on trees subjected to stresses
[NASA-CR-127420] N72-27375
TRITIUM
Performance of solid and gaseous tritium targets as neutron generators
[NASA-TT-F-14337] N72-27719
TROPICAL STORMS
Technique for analyzing and forecasting tropical cyclone intensities by satellite pictures
[NOAA-TM-NESS-36] N72-27641
TUNGSTATES
Growth of single crystals of mixed titanates and tungstates
[NASA-CR-120949] N72-27792
TURBINE BLADES
Flow characteristics of turbine airfoil cooling system components
[NASA-CR-120883] N72-27290
High temperature tests to determine oxidation resistance and mechanical properties retention of porous alloy materials suitable for transpiration cooled vanes
[NASA-CR-1999] N72-27819
TURBINE ENGINES
Design and development of movable turbine inlet guide vanes to provide aerodynamic choking for jet engine
[NASA-CASE-LAR-10642-1] N72-27820
TURBINE WHEELS
Photoelastic measurement of stresses on axial flow compressor disc with numerous pin hole perforations
[NAL-TR-274] N72-27948
TURBOFANS
Application of streamline curvature method for determining performance of turbofans and comparison with empirical results
[NAL-TR-268T] N72-26999
TURBOJET ENGINES
Design and fabrication of low cost turbojet and turbofan engines
[NASA-TM-X-68085] N72-27816
Analysis of carbon monoxide, unburned hydrocarbons, and nitrogen oxides in turbojet afterburner combustion products using infrared spectroscopy - Part 1
[AD-739176] N72-27968
Computer program for determining history of combustion products produced by turbojet engine afterburner - Part 2
[AD-739177] N72-27969
TURBULENCE
Relationship between turbulence coefficient and temperature and wind distribution in lower boundary layer
[AD-739221] N72-27658

TURBULENCE EFFECTS
Effects of upper atmosphere turbulence on operation of supersonic transport aircraft and methods for advance detection of atmospheric turbulence
[NLL-M-22437-[5828.4F]] N72-27009

TURBULENT BOUNDARY LAYER
Incoherent scattering cross sections of turbulent boundary layer adjacent to conducting plane and cylindrical surfaces
[AD-738632] N72-27193
Turbulent boundary layers along curved walls of axisymmetric diffusing annulus
[NAL-TR-278T] N72-27316

TURBULENT DIFFUSION
Interaction between sonic two dimensional secondary injection jet and supersonic stream with axial pressure gradient
N72-27288
Elastic boundary interaction with viscous sublayer of turbulent boundary layer flow for drag reduction
[NASA-TT-F-14391] N72-27315

TURBULENT FLOW
Location of laminar-turbulent transition in wake of 22-deg half angle sharp cones at hypersonic speed
[AD-739318] N72-27326
Measuring values characterizing structure of turbulent flow by hot-wire anemometers
[NLL-TRANS-T-1521-[9022.305]]
N72-27413
Different combustion diagrams of jets for study on turbulent pulsations in temperature
[AD-739292] N72-27970

TURING MACHINES
Automata with undirected labeled graphs as Turing machines
[TR-72-182] N72-27216

TWO DIMENSIONAL FLOW
Subsonic, two dimensional wall interference effect in perforated transonic wind tunnel
[NAL-TR-252T] N72-27318
Computer program for coordinates, incompressible inviscid section characteristics, and two dimensional drag-rise for NACA airfoils
[AD-738623] N72-27332

U

U.S.S.R.
Characteristics and operation of air trafic control radar system installed at USSR airports
[JPRS-56463] N72-27705

U.S.S.R. SPACE PROGRAM
Agreement between US and USSR for cooperative space missions and compatibility of spacecraft components
N72-27972

UH-1 HELICOPTER
Design, development, and evaluation of three-axis hydrofluidic stability augmentation system for UH-1 helicopter
[AD-739559] N72-27045

ULTRAHIGH FREQUENCIES
Monochromator excited by ultrahigh frequency electrodeless discharge for Lyman alpha calibrating
N72-27463

ULTRAHIGH VACUUM
Nanosecond pulses for study of electric breakdown mechanism of ultrahigh vacuum
[AD-739280] N72-27743

ULTRASONIC MACHINING
Quality control and limitations of mirror ultrasonic machining
N72-27451

ULTRASONIC TESTS
Ultrasonic adjustable scanner for flaw detection in flat or radial panels of honeycomb structure with welded seams
[NASA-CASE-MFS-20335-1] N72-27421
Inspection techniques for coated refractory metals and filamentary composites
N72-27518

ULTRAVIOLET FILTERS
Specifications for onboard ultraviolet thin metallic film mirrors, filters, and interferometers for aerospace environments
N72-27446

ULTRAVIOLET RADIATION
Onboard photomultiplier tubes sensitive to ultraviolet radiation developed for Signe, OSO, and D2B projects
N72-27436
Feasibility of Cerenkov laser to achieve broadly tunable laser action in ultraviolet region and beyond
[AD-739377] N72-27553

ULTRAVIOLET SPECTROMETERS
Characteristics and applications of industrial photometers for analyzing constituent parts of liquid and gaseous mixtures
[NLL-SMRE-TRANS-5691-[8313.4]]
N72-27414

ULTRAVIOLET SPECTROPHOTOMETERS
High resolution photomultiplier tube for onboard far ultraviolet photometer in aerospace environment
N72-27441
Specifications for holographic gratings for spectrophotometer onboard French D2A polar satellite for Lyman beta studies
N72-27449

UNDERWATER ACOUSTICS
Ocean bottom acoustic reflection profiles for Greater and Lesser Antilles
[PB-207596] N72-27389
On-axis, far field, difference frequency pressure generated in high amplitude, primary sound field
[AD-739321] N72-27740

UNDERWATER BREATHING APPARATUS
Design of gas mixture breathing systems for underwater diver equipment
N72-27108
Design of deep sea heavy duty diving equipment for salvage divers
N72-27118
Performance of closed circuit mixed gas underwater breathing apparatus
N72-27119

UNDERWATER ENGINEERING
Development of deep sea diving technology
N72-27100
Hydrospace simulator facility for testing material properties at sea depths to 1000 FSW
[AD-739695] N72-27283

UNITED STATES OF AMERICA
Aeronautical history leading to American space exploration
[PUBL-70-10] N72-27980

UNITS OF MEASUREMENT
Standard and scales of international system of units
[NBS-SP-330] N72-27525
Proceedings of conference on weights and measures conducted by National Bureau of Standards in July 1971
[NBS-SP-358] N72-27975

UNIVAC 1108 COMPUTER
FORTRAN extended graph algorithmic language for Univac 1108
[NASA-CR-127263] N72-27206

UNIVERSITIES
Statistical analysis of Federal obligations awarded to universities and colleges for academic science activities for fiscal year 1970
[NSF-72-301] N72-27978

UNSTEADY FLOW
Three approximation methods for full Navier-Stokes equations for two and three dimensional unsteady flow
N72-27296
Nonstationary flow of viscous incompressible fluid in bounded domain
N72-27297

UPPER ATMOSPHERE
Measurements of upper-atmosphere rotational speed from changes in satellite orbits
[RAE-TR-71171] N72-27900

URANIUM ALLOYS
Diffusion scattering of X rays by solid U-Mo solution
[AD-739226] N72-27587

URBAN TRANSPORTATION
Updating maps of transportation networks by space photography
[NASA-CR-127530] N72-27422

UTILITY AIRCRAFT
Aircraft accident investigations of crashes of agricultural aircraft and effectiveness of protective equipment in preventing injuries and fatalities
[FAA-AM-72-15] N72-27011

V

V/STOL AIRCRAFT
Compilation of technical reports on missile design, missile guidance, helicopter stability, VTOL aircraft, and wind tunnel design - Vol. 3
[SBN-11-470153-9] N72-26995
Development of composite structure for propeller blade retention on V/STOL aircraft propulsion system
[AD-739555] N72-27047

VACANCIES (CRYSTAL DEFECTS)
Crystal dislocations and vacancy movement
[NLL-M-21377-[5828.4F]] N72-27787

VACUUM APPARATUS
Inductance device with vacuum insulation and materials of low gas entrapping capability
[NASA-CASE-LEW-10330-1] N72-27226
Vacuum device used for plotting isothermal diagrams of titanium alloys by X ray diffraction method
[AD-739219] N72-27586
Nanosecond pulses for study of electric breakdown mechanism of ultrahigh vacuum
[AD-739280] N72-27743

VACUUM CHAMBERS
Life support system for rescue crew in altitude chamber tests
N72-27133
Vacuum chamber with scale model of rocket engine base area of space vehicle
[NASA-CASE-MFS-20620] N72-27262

VACUUM DEPOSITION
Thin film vacuum deposition for optical surface finishing, noting dihedral deposition on reflector surface
N72-27454

VACUUM EFFECTS
Response of shroud-enclosed spacecraft to combined acoustic-vacuum environments
[NASA-TM-X-65922] N72-27734

VAPORS
Effect of vapor and liquids on friction and wear of molybdenum disulfide
[NLL-RISLEY-TR-2363-[9091.9F]]
N72-27146

VARIANCE (ST .TISTICS)
Virtual measure variance reduction technique in computer simulation
[P-4817] N72-27213
Smooth empirical Bayes estimator for random scale components of observation error variances for discrete time linear system
[NASA-CR-127527] N72-27620

VECTOR ANALYSIS
Development of frequency model for single degree of freedom rate integrating gyroscope using Eulerian formulation
[AD-739182] N72-27711

VEGETATION
Bibliography of simulation models for vegetation
[NASA-CR-127426] N72-27082

VELOCITY
Forward speed effect on lift power of two dimensional jet ground effect support
N72-27006

VELOCITY MEASUREMENT
Measurements of upper-atmosphere rotational speed from changes in satellite orbits
[RAE-TR-71171] N72-27900

VENERA 6 SATELLITE
Mariner 5 and Venera 4, 5, and 6 pressure vs temperature data for Venus
[NASA-TM-X-65929] N72-27888

VENEZUELA
Subbottom acoustic reflection from continental shelf off Venezuela
[PB-207597] N72-27392

VENUS ATMOSPHERE
Mariner 5 and Venera 4, 5, and 6 pressure vs temperature data for Venus
[NASA-TM-X-65929] N72-27888

VERTICAL TAKEOFF AIRCRAFT
Performance tests to determine problems associated with hovering, vertical takeoff, and landing of VTOL aircraft with emphasis on attitude control
[NAL-TR-276] N72-27027

VERY LOW FREQUENCIES
Calculated phase and amplitude from VLF-LF ionospheric channels
[AD-739686] N72-27202

VESTIBULAR TESTS
Physical models for visual - vestibular interactions in simulating human nystagmic eye movements
[AD-737795] N72-27090
Tests of broadband high intensity noise on human equilibrium
[AD-737826] N72-27093
Vestibular-ocular counterroll reflex for determining vestibular response dynamics of monkeys to acceleration
[AD-737828] N72-27094

VIABILITY
Viability of staphylococci isolated from humans subjected to long term isolation in pressurized cabins
[NLL-RTS-7117] N72-27074

VIBRATION
Numerical analyses of large amplitude vibrations of thin elastic plates and shallow shells under random excitation and limiting boundary conditions
[AD-739976] N72-27958

VIBRATION EFFECTS
Vibration frequency effect on coefficient of static friction
[AD-739279] N72-27535
Development of optimal control theory and application to mass design of simply supported shear plate with fixed fundamental frequency of vibration
[NASA-CR-2044] N72-27945

VIBRATION TESTS
Performance tests to determine problems associated with hovering, vertical takeoff, and landing of VTOL aircraft with emphasis on attitude control
[NAL-TR-276] N72-27027
Fixture for supporting articles during vibration tests comprising integral annular unit
[NASA-CASE-MFS-20523] N72-27412
Acoustic vibratory response of structural OGO model enclosed in shroud and without shroud
[NASA-TM-X-65921] N72-27735

Vibration analysis of three parallel beams with different rigidities based on Rayleigh-Ritz method with three approximated deflection functions
[NAL-TR-271] N72-27949
Dynamic stability of rods connected by spring when subjected to periodic longitudinal loading and comparison with theoretical considerations
[NAL-TR-257] N72-27953
Application of hybrid finite element method for analyzing vibration properties of cylindrical shells
N72-27954

VIBRATIONAL SPECTRA
Kinetic and energetic behavior of vibrationally excited hydrogen molecules
[AD-739524] N72-27165

VIDICONS
Data storage system with vidicon tube for electrical input/output signal processing
[NASA-CASE-MSC-14053-1] N72-27215
Onboard supervidicon-fiber optical assembly of image converter/integrator vidicon for UV stellar radiation
N72-27445

VIRGINIA
Environmental impact statement for Wallops Station Virginia
[NASA-TM-X-68547] N72-27265

VISCOUS FLOW
Viscosity coefficient characterization by mass or heat diffusion coefficients
[NLL-T-1507-[9022.305]] N72-27289
Numerical analysis of viscous gas flow and shock formation
N72-27300
Extension of time dependent technique for inviscid blunt body flow to viscous flow
N72-27303

VISCOUS FLUIDS
Nonstationary flow of viscous incompressible fluid in bounded domain
N72-27297
Navier-Stokes equations of viscous incompressible fluid in bounded domain
N72-27298
Viscous compressible fluid flow in domain bounded by two coaxial, elastic cylindrical shells
N72-27309

VISUAL PERCEPTION
Analysis of pilot performance in establishing specific glide path by reference to oblong diamond marks on runway
[FAA-NA-72-57] N72-27702

VOCODERS
Asynchronous vocoder sampling and pulse coding of speech
[NASA-CR-127256] N72-27205

VOICE COMMUNICATION
Systems analysis of analog and digital voice coding techniques for use with satellite based air traffic control system
[NASA-CR-122432] N72-27701

VOLCANOLOGY
Chemical variability of Kilauea and Mauna Loa lava and model for origin of Kilauea
[USGS-PP-735] N72-27366

VOLTAGE REGULATORS
Feedback controlled dc to dc converter with input/output isolation for voltage regulation
[NASA-CASE-HQN-10792-1] N72-27230

VORTEX STREETS
Vortex model for describing steady and unsteady free boundary flows
N72-27287

VORTICES
Analysis of helicopter rotor wake patterns using water tunnel test facility
[AD-739946] N72-27052

W

WAKES
Approximate shock wave model for studying radial density distribution and refractive index in wake of shell in hypersonic flight
[ISL-16/71] N72-27323
Location of laminar-turbulent transition in wake of 22-deg half angle sharp cones at hypersonic speed
[AD-739318] N72-27326

WALL FLOW
Elastic boundary interaction with viscous sublayer of turbulent boundary layer flow for drag reduction
[NASA-TT-F-14391] N72-27315
Subsonic, two dimensional wall interference effect in perforated transonic wind tunnel
[NAL-TR-252T] N72-27318

WALLOPS ISLAND
Environmental impact statement for Wallops Station Virginia
[NASA-TM-X-68547] N72-27265

WARNING SYSTEMS
Development and characteristics of electronic signalling system and data processing equipment for warning system to avoid midair collisions between aircraft
[NASA-CASE-LAR-10717-1] N72-27703

WASTE DISPOSAL
Pressurized tank for feeding liquid waste into processing equipment
[NASA-CASE-LAR-10365-1] N72-27102

WATER
Water cooled pressure suit with regional body cooling for metabolic heat removal
N72-27124
Gas chromatography and chelation for metal trace determinations in water and human body
[AD-739865] N72-27166

WATER BALANCE
Water and heat balance effects on moisture content of slope soils
[NLL-M-22458-[5828.4F]] N72-27344

WATER EROSION
Wind barrier configuratons for rain erosion test section of rocket sled test track at Holloman AFB
[AD-739484] N72-27282

WATER MANAGEMENT
Hydrological computer codes and algorithms for water management and snow surveys
[NLL-M-22339-[5828.4F]] N72-27342

WATER POLLUTION
Automatic methods based on computers for processing hydrochemical data for USSR hydrometeorological service
[NLL-M-22307-[5828.4F]] N72-27270
Annotated bibliography of remote sensing of air and water pollution for 1965 through 1970
[AD-737588] N72-27406

WATER VEHICLES
Portable life support system for protective fully enclosed suits of shipboard personnel
N72-27111

WATER WAVES
Wind waves and wave pressure in subsurface bay waters
[NLL-TRANS-2508-[3623.66]] N72-27337

WAVE FUNCTIONS
Optimization technique for determining exact energy and wave functions in exchange perturbation processes
[NASA-CR-127265] N72-27154
Effect of radial wave functions for baryons in symmetric quark model
[TR-72-122] N72-27765

WAVE PROPAGATION
Results of 15.3 GHz observations with ATS-5 satellite
[NASA-CR-122438] N72-27174
Characteristic equations in generalized curvilinear tensor form for solving elastic wave propagation problems
[NASA-CR-127122] N72-27176
First and second moments of optical wave propagating in random medium and solution equivalence of Dyson and Bethe-Salpeter equation and Huygens-Fresnal principle
[AD-739185] N72-27746

WAVE REFLECTION
Incoherent scattering cross sections of turbulent boundary layer adjacent to conducting plane and cylindrical surfaces
[AD-738632] N72-27193
Ocean bottom acoustic reflection profiles for Greater and Lesser Antilles
[PB-207596] N72-27389
Acoustic reflection profiles from ocean bottom east of Yucatan Peninsula
[PB-207595] N72-27390
Subbottom acoustic reflection profiles for Bay of Campeche in Gulf of Mexico
[PB-207594] N72-27391
Subbottom acoustic reflection from continental shelf off Venezuela
[PB-207597] N72-27392
Average pulse shape measurements of radar sea return at near vertical incidence
N72-27651

WAVEGUIDES
Electrical characteristics of spiral groove delay system for centimeter wave band
[JPRS-56385] N72-27175

WEAPON SYSTEMS
Scientific research projects on lasers, surveillance, armaments, materials and weapon analysis
[DREV-666/72] N72-27982
Development of model for analyzing and controlling procedures for acquisition of weapon systems
[P-4794] N72-27984

WEAPONS DEVELOPMENT
Application of control system requirements to development of tactical missile weapon systems
N72-27683
Development of model for analyzing and controlling procedures for acquisition of weapon systems
[P-4794] N72-27984

WEAR INHIBITORS
Wear resistance of chrome vanadium steels and dependence on distribution of alloying elements in martensite and carbides
[AD-739276] N72-27581
Thermoelastic processes in surface layer of wear resistant metals subjected to abrasive wear
[AD-739277] N72-27582
Increase in wear resistance of chrome-nickel cast iron by alloying with niobium
[AD-739285] N72-27583

WEAR TESTS
Effects of hardness and microstructure of carbides of transition metals on abrasive wear resistance properties
[NLL-RTS-7289] N72-27513
Testing cast iron-hardened steel friction pairs
[AD-739278] N72-27534

WEATHER
Atmospheric models for mesoscale and small scale effects which influence global climate and weather
[AD-739541] N72-27669

WEATHER FORECASTING
Weather predictions for Concorde test flights and problems of forecasting stratospheric temperature and clear air turbulence
[NLL-M-22439-[5828.4F]] N72-27638
Analysis of cold fronts in Sea of Japan
[NLL-M-22454-[5828.4F]] N72-27639
Technique for analyzing and forecasting tropical cyclone intensities by satellite pictures
[NOAA-TM-NESS-36] N72-27641
Regression methods in five day mean height prediction at 500 mb using mean Nimbus 2 composited infrared data for identical periods in update procedure
[AD-739358] N72-27656
Solving equations of hydrothermodynamics for weather forecasting
[AD-739239] N72-27657
Meteorological satellite coverage, measurement, and application of data in weather forecasting
[AD-739291] N72-27665

WEATHER MODIFICATION
Weather modification research and development by Navy
[AD-739364] N72-27667

WEATHER STATIONS
Meteorological observations by network of weather stations in Odenwald area of Germany
[REPT-128] N72-27635

WEIGHT [MASS]
Statistical analysis of flight time, takeoff and landing weight, fuel weight at takeoff and landing for transport jet aircraft
[TB-88] N72-27035

WEIGHT MEASUREMENT
Error source in micro-weighting of radioactivity drop
[NLL-M-22443-[5828.4F]] N72-27749
Proceedings of conference on weights and measures conducted by National Bureau of Standards in July 1971
[NBS-SP-358] N72-27975

WEIGHTING FUNCTIONS
Upper bounds for constant weight error correcting codes
[R-916-1-NSF] N72-27621

WEIGHTLESSNESS
Zero gravity, constant flow electrophoretic separating apparatus
[NASA-CASE-MFS-21394-1] N72-27310

WELD STRENGTH
Application of continuous cooling transformation diagrams for determining properties of various metals following exposure to welding procedures
[NLL-LTI-746-1053-[9022.401]]
N72-27514
Production of austenitic-boride steels and alloys for welded structures with emphasis on effects of boron on weldability, refractoriness, and corrosion
[JPRS-56406] N72-27578

WELDABILITY
Fracture strength of high strength steel HFX 103 after quenching and annealing for weldability assessment
[T-MITT-4/71] N72-27579

WELDED JOINTS
Toughness of heat-affected zone of stress-relieved, automatic submerged-arc, pressure vessel seam weld in steels
N72-27496
Design method for estimating fatigue life of seam-welded pipelines subjected to fluctuating pressures
N72-27499
Approximate method for estimating residual stresses caused by longitudinal weld shrinkage
N72-27500
Data for estimating strength and performance of fillet-welded joints
N72-27501
Resistance projection welding of large cross section joints for machine components
N72-27507

Application of continuous cooling transformation diagrams for determining properties of various metals following exposure to welding procedures
[NLL-LTI-746-1053-[9022.401]] N72-27514
Fatigue strength and crack propagation in welded joints
[AD-739341] N72-27540
Production of austenitic-boride steels and alloys for welded structures with emphasis on effects of boron on weldability, refractoriness, and corrosion
[JPRS-56406] N72-27578

WELDED STRUCTURES
Conference on improving welded product design N72-27491
Research and development in high temperature welded structures N72-27493
Analyzing failure of welded structures to determine design criteria for preventing brittle fracture initiation N72-27495
Relevance of quality control tests by material producer to welded design N72-27497
Code of practice for designing welded structures subjected to fatigue loading N72-27498
Series of welded structure design N72-27509
Criteria for optimum design of welded structures to withstand dynamic service stresses N72-27510
Discussions on papers presented at conference on improving design of welded products N72-27511

WELDING
Training requirements for welding design N72-27502
Heat exchanger tube-to-tubeplate welded joints for thin walled tubes N72-27506
Improved design of welded LD vessels used in steel production N72-27508

WELDING MACHINES
High integrity tube-to-tubeplate bore welds for sodium cooled fast reactor N72-27505

WEST INDIES
Ocean bottom acoustic reflection profiles for Greater and Lesser Antilles
[PB-207596] N72-27389

WETTING
Formation and breakdown of water film moving over solid surfaces
[NASA-TM-X-68071] N72-27291

WHISKER COMPOSITES
Production, application, and properties of polycrystalline metal whiskers used with composite materials
[NLL-TRANS-746-1106-[9022.401]] N72-27555
Thermal stability of aluminum oxide whiskers in silicon-aluminum alloy matrix
[AD-736973] N72-27608

WHITE DWARF STARS
Atmospheric models for white dwarfs N72-27842

WIND [METEOROLOGY]
Combined analysis of data on radiometric satellite and wind waves from Cosmos 243
[NASA-TT-F-14400] N72-27170
Wind waves and wave pressure in subsurface bay waters
[NLL-TRANS-2508-[3623.66]] N72-27337
Relationship between turbulence coefficient and temperature and wind distribution in lower boundary layer
[AD-739221] N72-27658

WIND TUNNEL APPARATUS
Development of algorithm based on matrix methods for solution of wind tunnel force-balance equations and iterative solution using automatic computer reduction
[NASA-TN-D-6860] N72-27002

WIND TUNNEL MODELS
Engine airplane interference corrections in calculating model aircraft performance from wind tunnel test data N72-27017
Wind tunnel test requirements for simulating nozzle parameters and nozzle airframe interference characteristics N72-27021
Wind tunnel tests to determine opening dynamics of parachutes inflating under finite mass conditions using solid flat and ringslot configurations
[AD-739554] N72-27046
Method for designing wind tunnel model airfoil with integrally formed pressure measurement orifices
[NASA-CASE-LAR-10812-1] N72-27272
Wind tunnel tests to determine static longitudinal and lateral-directional aerodynamic effects of various configuration changes on parametric delta wing orbiter
[NASA-CR-123722] N72-27923
Wind tunnel tests to determine pressure distribution of space shuttle abort stage under various conditions of Mach number, Reynolds number, and angles of attack - Vol. 1, Pt. A
[NASA-CR-120008-VOL-1-PT-A] N72-27924

WIND TUNNEL STABILITY TESTS
Hypersonic wind tunnel tests on delta wing models at high incidence for pressure distribution determination
[ARC-CP-1198] N72-27004
Wind tunnel tests to determine pressure distribution on space shuttle scale model in abort mode configuration under various aerodynamic conditions -Vol. 1 Pt. B
[NASA-CR-120008-VOL-1-PT-B] N72-27925
Wind tunnel tests to determine abort separation pressures on space shuttle orbiter at Mach 5 - Vol. 2 Pt B
[NASA-CR-120061] N72-27926
Wind tunnel tests to determine pressure distribution on space shuttle booster in abort configuration at Mach 3 - Vol. 3
[NASA-CR-120062] N72-27927
Wind tunnel tests to determine pressure distribution on space shuttle orbiter in abort configuration at Mach 3 - Vol. 4
[NASA-CR-120063] N72-27928
Wind tunnel tests to determine pressure distribution on space shuttle booster in abort configuration at Mach 2 - Vol. 5
[NASA-CR-120064] N72-27929
Wind tunnel tests to determine pressure distribution on space shuttle orbiter in abort configuration at Mach 2 - Vol. 6
[NASA-CR-120065] N72-27930

WIND TUNNELS
Compilation of technical reports on missile design, missile guidance, helicopter stability, VTOL aircraft, and wind tunnel design - Vol. 3
[SBN-11-470153-9] N72-26995
Development of algorithm based on matrix methods for solution of wind tunnel force-balance equations and iterative solution using automatic computer reduction
[NASA-TN-D-6860] N72-27002
Wind tunnel tests for heat transfer distributions on LMSC 040C and 040A-L4 Delta wing space shuttle orbiter
[NASA-CR-120072] N72-27935

WING LOADING
Fatigue crack propagation in Fokker F-28 full-scale wing structure under cyclic gust flight simulation loading
[NLR-TR-71043-U] N72-27955

WING PANELS
Aerodynamic interference between wing and surface of velocity discontinuity in nonuniform potential flow field
[NAL-TR-254] N72-27000

WINTER
Relation between stratospheric circulation and pressure distributions at summer-autumn transition and following winter severity for Kyushv district
[NLL-M-22196-[5828.4F]] N72-27637

WIRE
Computer programs for analyzing electromagnetic radiation fields of bent thin wire antennas and scatterers
[AD-739203] N72-27190

WISCONSIN
Environmental impact survey of airport on Park Falls, Wisconsin
[PB-204025-F] N72-27284

WORK FUNCTIONS
Czochralski technique for improving growth and characterization of GaAs and mixed III and V semiconductor cr stals
[AD-739374] N72-27807

WORK HARDENING
Uniform elongation and work hardening of sheet and spherical aluminum and copper alloys, brass, and steel
[NLL-TRANS-746-1121-[9022.401]] N72-27557

WYOMING
Remote sensing of Yellowstone National Park
[NASA-CR-127531] N72-27352
Environmental impact survey of hail in Colorado, Wyoming, and Nebraska
[PB-207539-F] N72-27661

X

X RAY APPARATUS
Small electron gun with four electrodes for Auger and ultrasoft X ray instruments
[PB-207208] N72-27240

X RAY DIFFRACTION
Vacuum device used for plotting isothermal diagrams of titanium alloys by X ray diffraction method
[AD-739219] N72-27586

X RAY FLUORESCENCE
Ultraminiature X ray fluorescence spectrometer for determining element composition data
[NASA-CR-127526] N72-27846

X RAY INSPECTION
Inspection techniques for coated refractory metals and filamentary composites N72-27518

X RAY IRRADIATION
X ray and laser irradiation of glycol sulfate crystals in relation to nucleation and spontaneous polarization
[NLL-TRANS-855-[9022.64]] N72-27148

X RAY SCATTERING
Diffusion scattering of X rays by solid U-Mo solution
[AD-739226] N72-27587

X RAYS
X ray lines from multicharged ions of iron from hot laser
[AD-739255] N72-27160

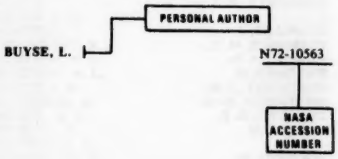
Z

ZINC
Engineering evaluation of AA size primary, nonreserve zinc-air batteries for use in portable communications equipment
[AD-739490] N72-27073

ZINC COATINGS
Mechanism, extent, and testing of galvanic corrosion of metals
[NLL-TRANS-746-1174-[9022.401]] N72-27147

PERSONAL AUTHOR INDEX

TYPICAL PERSONAL AUTHOR INDEX LISTING



Listings in this index are arranged alphabetically by personal author. The NASA accession number denotes the number by which the citation is identified.

A

ABBOTT, J. K. N72-27080
ABDELWAHAB, M. N72-27014
ACACCIA, G. M. N72-27220
ACUS, R. W., JR. N72-27690
N72-27691
ADLER, I. N72-27880
AGLITSKII, E. V. N72-27160
AINSWORTH, J. E. N72-27888
AKATOV, A. K. N72-27074
ALBERS, J. A. N72-27286
N72-27817
ALBRECHT, H. J. N72-27188
N72-27189
ALEEV, L. S. N72-27083
N72-27134
ALEXOVICH, R. N72-27177
ALMERINI, A. L. N72-27071
ALTAISKII, Y. M. N72-27803
AMEURLAINE, J. N72-27440
ANDERKO, K. N72-27570
ANDERSON, K. A. N72-27889
ANDREEV, L. A. N72-27145
ANDREWS, T. W. N72-27484
ANGELE, W. N72-27731
ANISIMOV, E. N72-27882
ANTONATOS, P. P. N72-27018
ANTSIFEROV, V. N. N72-27563
AOKI, Y. N72-27950
ARAKI, S. N72-27407
ARCHER, G. L. N72-27495
ARGON, A. S. N72-27580
ARKHANGELSKAYA, L. N. N72-27594
ARMAND, J. P. N72-27945
ARTAMONOV, A. Y. N72-27513
ARTZNER, G. N72-27457
ASEEVA, R. M. N72-27142
ASHWORTH, B. R. N72-27271
ASKARYAN, G. N72-27281
ATENCIO, A., JR. N72-27031
AU, G. F. N72-27826
AUDET, N. F. N72-27111
N72-27283
AUGENSTEIN, B. W. N72-27983
AULEHLA, F. N72-27020
AULT, J. C. N72-27239

B

BABAEV, M. A. N72-27613
BABCOCK, M. L. N72-27205
BABKIN, V. F. N72-27172
BACCHI, H. N72-27461
BACHMEIER, A. N72-27229
BAGASAROVA, A. M. N72-27399
BAHRABADI, E. N72-27248
BAKER, B. N. N72-27987
BAKER, R. C. N72-27935
BALASKOVIC, P. N72-27444
N72-27470
BALDWIN, T. E., JR. N72-27196
N72-27197
N72-27198
N72-27199
N72-27200
BALLARD, H. N. N72-27403
BALLEW, R. W. N72-27845
BANAS, F. P. N72-27597
BANCHERO, N. N72-27078
BANKS, B. A. N72-27824
BARAT, C. N72-27441
BARBERA, A. J. N72-27053
BARENGOLTZ, J. N72-27857
BARKAYA, V. F. N72-27489
BARON, A. K. N72-27965
BARRETT, P. J. N72-27771
BARTLETT, R. G. N72-27129
BASILI, V. R. N72-27206
BAUER, P. T. N72-27070
BAYTON, J. A. N72-27986
BEAL, J. B. N72-27517
BEARD, D. B. N72-27863
BEARD, J. T. N72-27660
BEAUVAIS, M. N72-27445
BECK, A. J., JR. N72-27850
N72-27873
BECKER, H. H. N72-27486
BEGGS, J. C. N72-27109
BEKEY, G. A. N72-27214
BELEW, H. W., JR. N72-27262
BELL, F. C. N72-27975
BELLINGER, E. D. N72-27052
BELOUSOV, S. L. N72-27659
BEMENT, L. J. N72-27959
BENE, R. W. N72-27798
BENEDIKTOV, E. A. N72-27180
BENTLEY, R. A. N72-27127
BERGE, G. L. N72-27861
BERGERON, L. N72-27469
BERGHAGE, T. E. N72-27088
BERGSTROM, E. R. N72-27419
BERKEBILE, M. J. N72-27520
BERLIN, A. A. N72-27142
BERNSTEIN, M. J. N72-27610
BERNSTEIN, R. B. N72-27755
N72-27756
N72-27757
BERTSCH, D. L. N72-27833
BERTSCH, S. N72-27229
BESSEMOULIN, J. N72-27672
BESSONNEAU, G. N72-27437
BEYERS, N. J. N72-27403
BEZNER, J. S. N72-27096
BILLON, M. N72-27470
BILWAKESH, K. R. N72-27818
BIRCH, J. N. N72-27701
BIRCH, S. F. N72-27287
BIRELY, J. H. N72-27395
BIRNIE, J. V. N72-27503
BLACKABY, J. N72-27125
BLACKWELL, K. L. N72-27924
N72-27925
N72-27926
N72-27927
N72-27928
N72-27929
N72-27930
BLAGOI, Y. P. N72-27745
BLAIR, B. E. N72-27523
BLAIR, C. D. N72-27650
BLAKEMORE, J. S. N72-27809
BLALOCK, T. V. N72-27678
BLAMONT, J. E. N72-27423
BLAMOUTIER, M. N72-27445
BLANDFORD, R. R. N72-27393
BLANKENBURGS, G. N72-27601
BLAUEL, J. G. N72-27579
BLENKIN, R. N72-27492
BLETHROW, J. G. N72-27011
BLOCK, B. N72-27481
BLODGET, H. N72-27880
BLUME, H. C. N72-27486
BLYMILLER, E. R. N72-27485
BOCHAROVA, T. T. N72-27566
BODINAUD, J. N72-27600
BOIKO, V. A. N72-27160
BOLAND N72-27974
BORISOV, V. N72-27883
BOSTROEM, R. N72-27385
BOTTCHER, J. H. N72-27231
BOUCK, L. S. N72-27813
BOURCIER, H. N72-27461
BOURICHON, J. N72-27079
BOURRIEAU, J. N72-27456
BOUTOT, J. P. N72-27443
BOUYSSOU, J. N72-27441
BOVKUN, G. A. N72-27513
BOWERS, D. L. N72-27332
BOWMAN, J. C. N72-27482
BOYLE, J. C. N72-27274
BOYLE, R. J. N72-27966
BRAGIN, B. K. N72-27474
BRANDON, L. B. N72-27815
BREAKWELL, J. V. N72-27679
BREISACHER, P. N72-27163
BREITER, M. N72-27152
BRETON, J. N72-27459
N72-27466
BRICE, N. N72-27865
BRIER, J. H. N72-27542
BRITT, J. E. N72-27714
BRIXIUS, N. L. N72-27477
BROOKS, P. D. N72-27406
BROWN, J. H., JR. N72-26996
BROWN, J. T. N72-27117
BROWN, R. D. N72-27094
BROWN, T. A. N72-27618
BROWN, W. F., JR. N72-27946
BRUCE, R. W. N72-27940
BRUCK, L. R. N72-27734
N72-27735
BRYSON, A. E., JR. N72-27679
BUCKLEY, D. H. N72-27150
BUEHRING, W. N72-27186
BUGAEV, S. P. N72-27743
BUGAEV, V. A. N72-27665
BUKIN, G. V. N72-27180
BUNIMOVICH, S. G. N72-27134
BURGESS, W. A. N72-27128
BURGGRAF, F. N72-27290
BURK, S. M., JR. N72-27033
BURRISS, W. L. N72-27054
N72-27064
BUSCH, M. B. N72-27451
BUSER, R. G. N72-27783
BUXBAUM, O. N72-27035
N72-27325
BYRNES, P. J. N72-27173

C

CALOGERO, F. N72-27769
CAMPBELL, D. K. N72-27758
CAMPBELL, G. S. N72-27282
CAMPBELL, J. N72-27544
CAMPBELL, J. E. N72-27077
CARERI, G. N72-27759
CARLQVIST, P. N72-27778
CARPENTER, R. N72-27121
CARR, T. D. N72-27860
CARROLL, H. N72-27420
CARSON, M. A. N72-27110
CARTER, E. C. N72-27019
CARTER, G. N72-27213
CARTER, H. G. N72-27718
CARTER, J. E. N72-27311
CARY, A. M., JR. N72-27312
CASKEY, P. E. N72-27078
CAUDY, D. W. N72-27116
CAUFFMAN, D. P. N72-27432
CAZALE, H. R. N72-27638
CAZES, S. N72-27463
CERUTTI-MAORI, G. N72-27454
CHAMBERS, A. B. N72-27125
N72-27126
CHANDRA, S. N72-27364
CHANG, E. T. N72-27475
CHAPMAN, R. L. N72-27986
CHARLIER, J. N72-27447
CHARYCHANSKII, V. V. N72-27418
CHATO, J. C. N72-27084
N72-27124
CHEKOTILO, L. V. N72-27578

CHEMERENKO, E. P. N72-27342
CHEN, C. S. N72-27660
CHEPURA, V. F. N72-27377
CHERNOGLAZOV, V. A. N72-27537
CHESTNUTT, D. N72-27820
CHEVALIER, J. L. N72-27573
CHILES, W. D. N72-27105
CHINCHEVOY, M. N. N72-27354
CHIPMAN, D. M. N72-27154
CHIU, Y. P. N72-27546
CHIU, Y. T. N72-27712
CHIZHIKOV, V. Y. N72-27699
CHOE H. M. N72-27243
CHOW, K. K. N72-27552
CHRISTIAN, J. R. N72-27499
CHRISTIAN, J. W. N72-27335
CHUBB, G. P. N72-27138
CIMINO, A. A. N72-27828
CLARE, T. A. N72-27245
CLARK, B. C. N72-27846
CLARK, D. E. N72-27918
CLARK, P. J. N72-27501
CLARK, R. L. N72-27157
CLAYTON, R. N72-27060
CLEARY, J. W. N72-27292
CLEMM, D. S. N72-27626
CLINE, R. W. N72-27736
CLINE, T. L. N72-27889
COFFIN, C. L. N72-27123
COGDELL, J. R. N72-27848
COHEN, C. J. N72-27245
COHEN, E. A. N72-27408
COLBUS, J. N72-27941
COLLINS, D. C. N72-27135
COLOMBANI, A. N72-27785

COMPTON, W. B., III N72-27786
CONDELL, W. J. N72-26997
CONGER, C. C. N72-27808
COOK, G. E. N72-27226
COOKE, G. C., IV N72-27897
COPELAND, R. J. N72-27006
CORON, N. N72-27114
CORONITI, F. V. N72-27438
N72-27347
N72-27770
N72-27868

CORRAO, P. N72-27092
COSTA, U. N72-27416
COUCH, R. H. N72-27703
COWHERD, W. F. N72-27242
CRANE, C. R. N72-27080
CRARY, J. H. N72-27202
CRAWFORD, L. W. N72-27968
N72-27969

CRAWFORD, R. G. N72-27077
CRAWFORD, W. E. N72-27251
CREUTZ, M. N72-27764
CROOM, D. L. N72-27840
CROSBIE, R. J. N72-27278
CROW, R. B. N72-27249
CULSHAW, W. N72-27552
CUMMINGS, R. L. N72-27816
CURTIS, D. L. N72-27132
CURTNER, K. L. N72-27713

D

DALMAN, G. C. N72-27259
DAMBIER, G. N72-27438
DAMEROW, W. P. N72-27290
DANESI, W. A. N72-27118
DANIELS, D. H. W. N72-27967
DARLASTON, B. J. L. N72-27493
DAVIES, R. N72-27162
DAVIS, J. P. N72-27228
DAVIS, J. W. N72-27262
DAVIS, L., JR. N72-27874
DAWSON, D. I. N72-27544
DE, T. N72-27622
N72-27623
N72-27765

DEAN, D. C. N72-27397
DEAN, D. S. N72-27277
DEAN, W. C. N72-27398
DEBEHOGNE, H. N72-27372
DECKER, J. P. N72-27924
N72-27925
N72-27926
N72-27927
N72-27928
N72-27929
N72-27930

DELAND, E. C. N72-27214
DELIL, A. A. M. N72-27967
DEMIDOVICH, V. M. N72-27537
DEMUTSKIY, V. P. N72-27750
DENAULT, G. C. N72-27163
DERLIK, P. N72-27955
DERYCKE, R. J. N72-27362
DESALOS, J. N72-27449
DESJARDINS, S. P. N72-27044
DESVIGNES, F. N72-27437
N72-27439
N72-27461

DETAILLE, M.
DEVRIES, G.
DEY, D.
DICKMANNS, E. D.
DICKSON, D. H.
DIETRICH, E.
DIETZ, H.
DIMAKSYAN, A. M.
DIMITIADES, B.
DITZ, J. P.
DIVINE, N.

DIVITA, E.
DMITRIEV, A. A.
DOBBS, M. B.
DOHERTY, W. R.
DOITTAU, F. X.
DOLAND, G. D.
DOLGINOV, S.
DOLGOVA, N. A.
DOROSHCHENKO, P. P.
DORSCH, R. G.
DOUSSET, C.
DOWDY, E.
DOWLAND, P. F.
DRESHFIELD, R. L.
DREWRY, J. E.
DRURY, M. L.
DUBAN, M.
DUBROFF, R. E.
DUFF, W. G.

DUKOWICZ, J. K.
DUMONT, F.
DUNN, B. D.
DUNN, J. H.
DURPAIRE, J. P.
DVORAK, V. F.
DWIGHT, J. B.
DYBAN, E. P.

E

EASTMAN, L. F.
EBERST, R. D.

EBIHARA, M.

EDWARD, D. C.
EDWARDS, W.
EGBERT, D. D.
EICHENBRENNER, F. F.
EICHHORN, W. L.
ELIAS, D. P.

ELKIN, R. F.
ELLER, E.
ELLIOTT, D. D.
ELLISON, J. C.
ELMORE, R. E.
ELSSNER, G.
ENDO, A.
ENDO, M.
ENGELKE, B. A.
ENIE, R. B.
EPIK, E. Y.
ERICKSON, R. C.
ERMOLENKO, I. N.
ERMOLOV, L. S.
ESCHARD, G.
ESCHRICHT, W.
ESELSON, B. N.
ESHKENAZI, V. I.

ESTRIN, G.
EVERETT, J. L.
EZIKASHVILI, O. S.

F

FABIAN, G. J.
FABIAN, H.
FAISAL, F. H. M.
FAUCHER, G. A.
FEARNEHOUGH, G. D.
FECHNER, H.
FEDEROV, A. N.
FEDOTOV, S. A.
FENG, S. Y. M.
FERRANTE, F. E.

FERRARA, R.
FERRARA, S.
FERRARO, A.
FERRI, A.

FESSENDEN, E.
FICHTEL, C. E. N72-27453
FICHTL, G. H. N72-27305
FICK, S. R. N72-27034
FICULA, F. N72-27891
FIEBIG, H. J. N72-27042
FIFE, W. A. N72-27653
FILIPPOV, S. I. N72-27336
FISCHBEIN, W. N72-27662
FISCHER, H. N72-27420
FISCHL, M. A. N72-27007
FISH, F. H. N72-27855
FISK, L. A. N72-27875
FITZHENRY, P. N72-27859
FLAHERTY, B. J. N72-27614
N72-27087

FLAMAND, J. N72-27866
FLEMINGS, M. C. N72-27461
FLIGEL, M. D. N72-27178
FLOCKAN, R. N72-27354
FLOURNOY, J. M. N72-27581
FONSH"EIN, N. M. N72-27583
FORSY'H, G. F. N72-27030
FORTIN, M. N72-27009
N72-27155

FOURNET, M. N72-27120
FOWLER, W. B. N72-27575
FR. DEFANT N72-27971
FRANK, K. H. N72-27497
FRANK, L. A. N72-27465
N72-27345

FRANK, L. S. N72-27196
FRANKLIN, G. F. N72-27197
FREDERICKS, R. W. N72-27198
FREEDMAN, E. N72-27199
FRENCH, B. M. N72-27200
FREUND, L. B. N72-27238
FREY, J. N72-27437
FRIDMAN, A. M. N72-27276
FRIDRIKHSEN, V. K. N72-27529
FRIED, B. D. N72-27459
N72-27641

FRITTS, D. H. N72-27500
FROISY, J. B. N72-27328
FROMM, J. E.
FROST, J. D., JR.
FROST, M. G.
FRYKLUND, D. H.
FUHS, A. E. N72-27259
FUJIEDA, H. N72-27936
FUJII, S. N72-27937
N72-27317

FUJITA, T. N72-27318
FUKATANI, T. N72-27499
N72-27201
N72-27422
N72-27947
N72-27732

G

GAGLIARDINI, A. N72-27836
GAIDUK, V. V. N72-27837
GALIVETS, D. V. N72-27273
GANDIN, L. S. N72-27880
GANSHEIMER, J. N72-27902
GAPOSCHKIN, E. M. N72-27923
GARDINIER, C. A. N72-27194
GARDNER, L. N72-27599
N72-27428

GARNER, H. D. N72-27428
GARRISON, L. E. N72-27417
GASAWAY, D. C. N72-27527
N72-27328

GASS, N. N72-27718
GATTO, R. N72-27605
GAUTHIER, M. F. N72-27582
GAVRILOV, A. N. N72-27442
GDALEVICH, G. L. N72-27794
GELB, L. L. N72-27745
GELMAN, G. N72-27743
GEORGE, A. N72-27744
GERARD, J. N72-27225
GERLER, V. M. N72-27710
GERSHBEYN, E. A. N72-27538
GES, A. P.
GESSWEIN, J.
GETOOR, R. K.
GETZIN, N.
GINOUX, J. J. N72-27279
GIROL, A. P. N72-27719
GLANCY, J. J. N72-27761
GLOVER, J. R. N72-27664
GOKCEN, N. A. N72-27496
GOLOVANENKO, S. A. N72-27636
GOMI, M. N72-27160
GOODSTEIN, R. N72-27399
N72-27230

GOODWIN, F. H. N72-27196
GORE, R. C. N72-27197
GORR, W. N72-27198
GOSSE, J. N72-27199
GOSSETT, J. L. N72-27200
GOTO, Y. N72-27642
GOUFALONE, A. N72-27624
GRAF, J. N72-27706
GRAHAM, R. W. N72-27016
GRAMONT, L. N72-27017
GRANJON, H. N72-27278
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N72-27989
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N72-27514

GRANOVSKAYA, R. A. N72-27175
GRANT, N. J. N72-27580
GRATTAN, P. A. N72-27159
GRAY, H. R. N72-27574
GREEN, J. A. N72-27104
GREENE, T. E. N72-27256
GREENHOW, W. A. N72-27717
GREENLEAF, J. N72-27078
GREENSPAN, D. N72-27334
GREGENYUK, S. S. N72-27582
GREGORY, P. C. N72-27682
N72-27688
GRIFFIN, O. G. N72-27127
N72-27130
GRIFFIN, R. N. N72-27310
GRIFFITHS, V. N72-27577
GRIGOREV, V. I. N72-27343
GRIGOREV, V. N. N72-27745
GRIGOROV, N. L. N72-27832
GRILLO, A. F. N72-27624
GROESBECK, D. N72-27029
GRONER, G. F. N72-27157
GROSH, R. C. N72-27649
GROSSKOPF, K. N72-27595
GRUENBAUM, B. N72-27628
GUAZZONI, G. E. N72-27072
GUBIN, V. I. N72-27657
GUHSE, R. D. N72-27288
GULKIS, S. N72-27862
GURNETT, D. A. N72-27350
GURNEY, T. R. N72-27498
GUSTAFSON, S. A. N72-27670
N72-27671
GUTIERREZ, O. A. N72-27012
GUTSTEIN, M. U. N72-27737

H

HAAS, D. W. N72-27922
HAAS, G. D. N72-27738
HADDAD, G. I. N72-27257
HADNI, A. N72-27148
HAFFNER, J. N72-27852
HAHN, D. N72-27546
HAHN, F. P. N72-27506
HAHN, H. N72-27608
HAI, F. N72-27610
HALA, R. A. N72-27480
HALCOMB, C. G. N72-27089
HALL, J. B., JR. N72-27102
HALL, R. A. N72-27278
HALL, R. G. N72-27549
HAMILTON, M. L. N72-27054
N72-27064
HAMILTON, W. N72-27356
HAMROCK, B. J. N72-27528
HAN, L. N72-27676
HANCE, H. V. N72-27552
HANSEN, L. C. N72-27166
HANSEN, O. R. N72-27108
HARAMI, K. N72-27639
HARDY, E. P., JR. N72-27724
HARRIS, C. S. N72-27093
HARTENSTEIN, R. N72-27211
HARTMAN, A. J. N72-27984
HASLER, A. F. N72-27652
HASSELMAN, D. P. H. N72-27609
HAWTHORNE, J. R. N72-27726
HAYAKAWA, H. N72-27791
HAYASHI, Y. N72-27949
HEAP, E. N72-27687
N72-27692
HEDIN, A. E. N72-27887
HEDTKE, J. C. N72-27046
HEEMSKERK, J. F. N72-27967
HEIDT, M. F. N72-27411
HEIMLICH, P. F. N72-27113
HEINRICH, H. G. N72-27046
HEINRICH, K. F. J. N72-27209
HELBERT, W. B., JR. N72-27527
HELLBAUM, R. F. N72-27232
HEMPHILL, W. R. N72-27351
N72-27353
HENDERSON, F. M. N72-27422
HENDRICKS, C. M. N72-27129
HENDRICKS, R. C. N72-27965
HENGSTENBERG, H. N72-27943
HENKES, W. C. N72-27348
HENRICHS, F. N72-27943
HEPPNER, J. P. N72-27365
HERLIN, M. A. N72-27258
HERMAN, J. R. N72-27888
HERTIG, B. A. N72-27084
N72-27124
HESS, J. A. N72-27224
HEYE, W. N72-27557
HEYMSFIELD, A. N72-27645
HICKS, W. A. N72-27163
HILL, E. K. N72-27421
HILLER, H. N72-27898
N72-27899
HILLIER, R. N72-27004
HINTON, B. B. N72-27887
HIRSCHBERG, J. G. N72-27782
HIRSCHFELDER, J. O. N72-27154
HOCHULI, U. N72-27550
HOFFMAN, K. N72-27640
HOHLFELD, K. N72-27417
HOLM, A. P. N72-27104
HOLMES, W. M. N72-27223
HOLMQUIST, C. O. N72-27100
HORLITZ, G. N72-27794
HORN, J. D. N72-27282
HORN, P. N72-27707
HOROWITZ, I. M. N72-27253
HSU, Y. Y. N72-27291
HUDLOW, M. D. N72-27666
HUDSON, R. D. N72-27349
HUDSON, W. R. N72-27824
HUFF, R. G. N72-27029
N72-27410
HUGHES, W. L. N72-27668
HUNG, J. C. N72-27673
N72-27674
N72-27675
N72-27676
N72-27677
HUNZINGER, J. J. N72-27460
N72-27462
HURIET, J. R. N72-27458
HYBOIS, R. N72-27439

I

IBRAHIMOV, I. I. N72-27613
IGNALL, E. N72-27213
ILIAS, D. J. N72-27836
N72-27837
IMIG, L. A. N72-27947
IMSHENETSKIY, A. A. N72-27081
INFOSINO, C. J. N72-27326
INMAN, D. L. N72-27404
INNANEN, W. G. N72-27835
INOUE, S. N72-27427
N72-27822
INUMARU, N. N72-27000
IONKINA, E. M. N72-27567
IRONS, R. P. N72-27713
ISHIDA, Y. N72-27317
IVANDIKOV, I. M. N72-27433
IVANOV, V. A. N72-27698
IVANOV, V. N. N72-27338
IVANOVA, A. N. N72-27753
IWAMURA, S. N72-27203
IYER, K. R. N72-27591
IZMAILOV, A. V. N72-27572
IZMAYLOV, Y. A. N72-27699
IZQUIERDO, M. N72-27403

J

JAARSMA, F. N72-27021
JACKSON, C. M., JR. N72-27272
JACOBSEN, I. N72-27634
JACQUET, P. A. N72-27488
JAECKEL, R. N72-27530
JAEGGY, B. C. N72-27323
JAKOB, G. N72-27229
JAMES, D. P. N72-27499
JAMES, E. C. N72-27285
JAMET, J. N72-27458
JANOTA, M. N72-27507
JEANMAIRE, M. N72-27323
JENNINGS, A. E. N72-27105
JENSEN, R. S. N72-27085
JOATTON, R. N72-27009
JOHANNIN-GILLES, A. N72-27450
JOHNSON, C. D. N72-27260
JOHNSON, S. M. N72-27621
JOHNSTON, A. R. N72-27409
JOHNSTON, W. V. N72-27430
JOLY, C. N72-27725
JONES, J. H. N72-27234
JONES, J. L. N72-27728
JORTNER, J. N72-27604
JUBB, J. E. M. N72-27497
JUDD, J. H. N72-27784
JULICH, P. M. N72-27082
JUNKER, A. M. N72-27094

K

KAI, T. N72-27027
KAINZ, J. N72-27783
KALINCENKO, V. M. N72-27270
KALISTRATOV, C. N. N72-27788
KAMIMOTO, G. N72-27275
N72-27772
N72-27773
N72-27774
N72-27775
KANAZAWA, T. N72-27075
KANDALAFT, R. N. N72-27039
KANEMATSU, H. N72-27958
KARAKASHEV, V. A. N72-27696
KARISHIN, V. F. N72-27615
KARPIS, J. N72-27069
KASATOCHKIN N72-27142
KASCAK, A. F. N72-27723
KASPER, H. W. N72-27694
KASSEL, S. N72-27779
KATASEV, L. A. N72-27377
KATSANIS, T. N72-27720
KAUTZ, E. F. N72-27036
KAWAMOTO, I. N72-26998
KEKELIDZE, M. A. N72-27585
KENNEDY, E. J. N72-27678
KENNEL, C. N72-27867
KENNEL, C. F. N72-27771
KERKHOF, F. N72-27603
KERLIN, E. E. N72-27718
KETTERING, G. N72-27693
KEWELL, J. N72-27545
KHUSAINOVA, B. N. N72-27802
KHVOROSTUKHIN, L. A. N72-27607
KILCHEVSKII, N. A. N72-27309
KIM, Y. S. N72-27622
N72-27623
N72-27765
KING-HELE, D. G. N72-27766
N72-27899
N72-27900
KINSEY, D. W. N72-27332
KIRCHGRABER, U. N72-27625
KIRST, M. A. N72-27704
KISS, C. J. N72-27195
KITTL, E. N72-27072
KLEINROCK, L. N72-27225
KLEMM, U. N72-27221
KLJUKIN, N. K. N72-27341
KLOPP, D. A. N72-27854
KNOPF, U. N72-27794
KNUST, G. N72-27794
KOBAYASHI, Y. N72-27950
KOBELEV, V. M. N72-27535
KOCH, C. C. N72-27818
KOCHER, R. N72-27554
KOERBER, G. N72-27323
KOFSKY, I. L. N72-27482
KOGAN, N. Y. N72-27697
KOLOMYTSKV, L. A. N72-27143
KOMLEV, A. M. N72-27340
KOMODA, M. N72-27026
KOMOV, V. P. N72-27961
KONDRATYEVA, M. A. N72-27832
KONNOVA, I. Y. N72-27559
KOOPMAN, B. O. N72-27710
KOPELEV, Y. F. N72-27535
KORNETZKI, M. N72-27729
KORTANEK, K. O. N72-27670
N72-27671
KOSHIISHI, H. N72-27932
KOSHINUMA, T. N72-27427
KOTOV, V. F. N72-27596
KOVDA, V. A. N72-27400
KOYAMA, R. Y. N72-27801
KOZLOV, V. D. N72-27832
KRAVETS, V. V. N72-27333
KREITMAN, M. M. N72-27810
KREY, P. W. N72-27724
KRIMER, B. I. N72-27566
KRISHNAIAH, P. R. N72-27626
KRIVOSHEEV, V. A. N72-27583
KUDRIN, A. B. N72-27615
KUEPFERS, W. N72-27483
KUGEL, C. P. N72-27714
KULIKOV, V. N72-27705
KULMBURG, A. N72-27556
KUNIO, T. N72-27950
KUNZ, R. N72-27625
KUO, D. N72-27190
KURAMOTO, M. N72-27950
KURBATOV, V. P. N72-27490
KURPAKOVA, T. A. N72-27630
KUSHNEREVSKII, I. V. N72-27180
KUSSMAN, A. N72-27576
KUZIN, I. P. N72-27399

L

LABUDDE, R. A. N72-27755
LAMAR, J. V. N72-27738
LAMOTHE, R. N72-27880
LAMPORT, J. E. N72-27847
LANDGREBE, A. J. N72-27052
LANSING, J. C., JR. N72-27736
LANTAIRES, J. N72-27439
LARE, P. J. N72-27608
LATHEM, W. C. N72-27824
LAVALLE, S. R. N72-27902
LAZAREVA, N. A. N72-27630
LEBLANC, J. N72-27438
LECORDIER, J. N72-27785
N72-27786
LEDBURY, K. J. N72-27602
LEE, C. A. N72-27259
LEE, L. A. N72-27589
LEE, R. D. N72-27233
LEE, W. A. N72-27158
LEES, W. L. N72-27246

LEGALLIC, Y. N72-27749
LEHMAN, G. M. N72-27040
LELLA, R. L. N72-27709
LEMAIRE, J. N72-27371
LEMAITRE, M. P. N72-27452
LEMPICKI, A. N72-27554
LENTS, J. M. N72-27968
N72-27969
LEO, R. J. N72-27084
LEONARD, W. B. N72-27552
LEONHARDT, F. N72-27944
LESCURE, W. J. N72-27099
LESNIKOVA, G. V. N72-27343
LEVANON, N. N72-27651
LEVERANCE, R. A. N72-27326
LEVINE, L. J. N72-27069
LEVINE, R. D. N72-27757
LEVY, P. M. N72-27804
LEWIS, E. T. N72-27250
LEWIS, J. H. N72-27717
LEWIS, R. P. N72-27097
LIAN, M. W. N72-27620
LIBERATORE, A. N72-27248
LIDMAN, W. G. N72-27577
LIEMOHN, H. B. N72-27869
LIGHT, D. J. N72-27412
LIN, R. P. N72-27889
LIN, T. N72-27798
LINDSEY, G. H. N72-27812
LINTZ, P. R. N72-27393
LIONS, J. L. N72-27295
LIPOMA, P. C. N72-27215
LIPSMAN, F. P. N72-27191
LISER, I. J. N72-27340
LISZKA, L. N72-27384
LLOYD, R. P. N72-27133
LOFERSKI, J. J. N72-27057
LOGINOV, V. F. N72-27830
LOIACONO, G. M. N72-27792
LONG, W. C. N72-27255
LONGSON, D. J. N72-27130
LOTER, K. N72-27020
LOVE, D. A. N72-27924
N72-27925
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N72-27927
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N72-27929
N72-27930
LOVE, R. G. N72-27127
LOW, F. J. N72-27901
LOWMAN, P. N72-27880
LUCE, R. G. N72-26996
LUCIFREDI, A. L. N72-27220
N72-27235
N72-27434
N72-27706
LUDWIG, L. P. N72-27522
LUKIN, D. S. N72-27379
LUTHEY, J. L. N72-27853
LUYTEN, W. J. N72-27849
LYNN, H. N72-27693
LYONS, E. A. N72-27277
LYULYEV, V. L. N72-27254

M

MACHERAUCH, E. N72-27562
N72-27942
MACK, H. N72-27396
MADDOX, S. J. N72-27498
MADSEN, P. N72-27819
MAGNUSSON, B. N72-27795
N72-27796
N72-27797
MAHLE, S. H. N72-27349
MAIR, D. N72-27078
MAKOVSKII, V. A. N72-27962
MAKSIMOV, V. L. N72-27474
MALHERBE, A. N72-27446
MALICH, C. W. N72-27131
MANATT, S. L. N72-27408
MANZHELII, G. N72-27745
MARRON, M. T. N72-27756
MARSHALL, W. C. N72-27606
MARTIN, F. E. N72-27112
MARTIN, F. L. N72-27656
MARTSINKEVICH, L. M. N72-27170
MARTYNOV, V. D. N72-27534
MARTYNYUK, S. P. N72-27780
MARTZ, H. F., JR. N72-27620
MARUEJOULS, G. N72-27463
MASHKOV, V. N. N72-27607
MASHKOVICH, S. A. N72-27659
MASON, A. A. N72-27968
N72-27969
MASSAZZA, F. N72-27416
MASSE, R. P. N72-27394
MASSEY, G. A. N72-27747
MATIUGIN, S. N. N72-27180
MATSUSUE, K. N72-27948
MATULIS, A. Y. N72-27754
MATVEYEV, D. T. N72-27170
MAYBUROV, V. B. N72-27254
MAYNARD, N. C.
MCAULAY, J. E.
MCCLENAHAN, J. O.
MCCOLLUM, P. A.
MCCREIGHT, L. R.
MCDONALD, T. E., JR.
MCGEE, K. W.
MCILWAIN
MCINTYRE, R. G.
MCLAUGHLIN, M. D.
MCLOUGHLIN, V. C. R.
MCNEAL, R. J.
MCWHORTER, A. L.
MEAD, G. D.
MEANS, J. D.
MECKLENBURG, H. J.
MEDOVAR, B. I.
MEISEL, W. S.
MELKANOFF, M.
MENICHELLI, V. J.
MERRILL, J. R., IV
MERZLYAKOV, V. P.
MESSENGER, R. A.
MESZTENYI, C. K.
METELKIN, A. F.
MEYER, V. M.
MICHEL, J.
MIDDLETON, J. H.
MIEHLE, W.
MIERS, B. T.
MIHALOV, J. D.
MIKHAILENKO, S. A.
MILGRAM, D. L.
MILHAUD, G.
MILLIGAN, R. V.
MILWEE, W. I., JR.
MINAICHEV, A. D.
MINARDI, J. E.
MINARIK, R.
MIROSHIN, R. N.
MISH, W.
MITTAUER, R. T.
MKHITARYAN, A. M.
MOEN, K.
MOFFETT, M. B.
MOHAPATRA, R. N.
MONGE, J. L.
MONIN, A. S.
MONTES, H. A.
MOON, G.
MOORE, G. W.
MORETTI, G.
MORGAN, A. H.
MORGAN, C. U.
MORI, H.
MORISON, W. B.
MORITA, M.
MORITZ, H.
MOROZ, L. S.
MORRIS, J. F.
MORRIS, T. F.
MOSLEY, R. L.
MOUKHTAR, M. S.
MOZEROV, N. P.
MUIR, D. C. F.
MULL, M. M.
MULLIKEN, R. F.
MUNK, W. H.
MUNTZ, R. R.
MURAKAMI, C.
MURAVEV, V. I.
MURMAN, E. M.
MURRAY, S. S.
MURTAUGH, J. P.
MURZINOV, I. N.
MUTA, T.
MYERS, R. A.
MYERS, R. L.
MYERS, V. I.
MYKLEBUST, R. L.

N

NALIVAYKO, V. I. N72-27432
NARAYANA, R. N. N72-27014
NASH, W. A. N72-27739
NAZARENKO, O. K. N72-27668
NEBBON, B. W. N72-27310
NEKHENDZI, Y. A. N72-27425
NENCINI, G. N72-27252
NEUBAUER, F. N72-27935
NEUBERGER, M. N72-27518
NEWMAN, R. P. N72-27282
NICHOLSON, S. N72-27010
NIERENBERG, W. A. N72-27159
NIKITIN, N. V. N72-27395
NIKOLAISHVILI, G. U. N72-27258
N72-27864
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NIMEROFF, I. N72-27524
NISHI, T. N72-27560
NISHIDA, M. N72-27319
NISHIHARA, M. N72-27564
NISHIMURA, H. N72-27027
NISHIMURA, M. N72-27772
NISHIO, K. N72-27427
N72-27428
NISHIWAKI, H. N72-26999
NOE, B. G. N72-27155
NORDTVEDT, K., JR. N72-27358
NOREEN, R. A. N72-27046
NORMAN, D. R. N72-27277
NORRIE, D. H. N72-27305
NOUE, S. N72-27823
NOUSE, H. N72-27427
N72-27822
N72-27823
NOVIKOV, A. G. N72-27631
NOVOTNY, J. E. N72-27411
NOWAKOWSKI, K. D. N72-27794
NOZ, M. E. N72-27765
N72-27766
NUSSLI, J. N72-27436
NYPAN, L. J. N72-27528

O

OBTEMPERANSKAYA, S. I. N72-27153
OBUKHOVSKII, V. V. N72-27586
ODEN, J. R. N72-27042
OEHIKERS, R. A. N72-27650
OGAWA, A. N72-27952
OGAWA, T. N72-27027
OGREN, H. D. N72-27045
OHATA, T. N72-27427
OHKAMI, Y. N72-27892
OHLMANN, R. C. N72-27552
OHMARU, K. N72-27269
OKIISI, T. H. N72-27316
OKONOGI, T. N72-27317
OLEKSIAK, R. E. N72-27250
OLIVIE, M. N72-27449
OLSEN, W. A. N72-27030
OLSON, C. E., JR. N72-27375
ONKEN, R. N72-27024
ONO, K. N72-27027
N72-27589
N72-27593
ONO, S. N72-27203
ORDWAY, F. N72-27608
ORNER, G. M. N72-27111
OSIPOV, V. G. N72-27568
OSSWALD, G. N72-27880
OTSUBO, K. N72-27931
OTSUJI, K. N72-27275
OTT, A. N72-27512
OUDIN, L. N72-27323

P

PAGE, C. H. N72-27525
PAKA, V. T. N72-27338
PALMAN, J. L., JR. N72-27476
PANDIKOW, W. N72-27181
PANTELL, R. H. N72-27553
PARCHINSKAYA, I. A. N72-27074
PARISI, G. N72-27624
PARKER, R. H. N72-27858
PARKER, R. J. N72-27573
PARRY, E. P. N72-27611
PASTORE N72-27973
PATEL, V. L. N72-27376
PAVELKO, V. L. N72-27270
PAVESI, B. N72-27653
PAYNE, P. N72-27065
N72-27066
PEACOCK, J. L. N72-27104
PELLER, I. C. N72-27965
PELLERIN, C. J. N72-27833
PELLOUX, R. M. N. N72-27580
PEPPER, S. V. N72-27150
PERALDI, A. N72-27468
PERAULT, A. M. N72-27079
PERCIVAL, D. B. N72-27549
PEREKHVATOV, I. K. N72-27180
PERLMUTTER, M. N72-27156
PERRIN, A. J. N72-27505
PERRIN, J. N72-27148
PERSON, J. A. N72-27940
PERSSON, H. N72-27777
PESSA, V. M. N72-27240
PETERS, H. E. N72-27549
N72-27763
PETERS, O. N72-27794
PETERS, W. R. N72-27091
PHILBRICK, C. R. N72-27664
PHILLIPS, D. N72-27647
PHLIEGER, G. A., JR. N72-27227
PICAULT, J. P. N72-27459
PIERCE, E. T. N72-27101
PIETRI, G. N72-27443
PIEUCHARD, G. N72-27448

PIGGOTT, B. R. N72-27510
PILKINGTON, J. A. N72-27898
PINCHUK, N. I. N72-27578
PITMAN, D. L. N72-27684
N72-27685
N72-27686
PLATOU, A. S. N72-27005
PLEVIN, J. N72-27381
POLOSINO, E. F. N72-27145
POLOVIN, R. V. N72-27750
POLTYRYEV, G. S. N72-27616
POLUKHIN, P. I. N72-27615
PONGRATZ, M. B. N72-27346
PORTENEUVE, J. N72-27449
PORTER, R. F. N72-26996
POTAK, Y. M. N72-27569
POWER, J. L. N72-27824
POWERS, B. G. N72-27013
PRASAD, C. N72-27660
PRAVDIN, A. V. N72-27615
PRICE, R. H. N72-27841
PRIMDAHL, F. N72-27415
PRINCE, D. C. N72-27818
PRIOR, R. W. N72-27321
PROGRUSHCHENKO, A. V. N72-27588
PROKHOROV, V. Y. N72-27074
PROSKUROVSKII, D. I. N72-27743
PROTHERO, W. A. N72-27404
PUREHRINGER, O. N72-27508
PURUSHOTHAM, K. S. N72-27680
PUTHOFF, R. L. N72-27721
PUTNEY, B. H. N72-27885
PYBUS, E. J. N72-27668
PYLDMAA, V. K. N72-27663

Q

QUIESSER, H. J. N72-27058

R

RAGHUNATHAN, S. N72-27419
RAHMAN, N. K. N72-27761
RAISBECK, G. N72-27710
RAMATY, R. N72-27889
RAMPY, J. M. N72-27924
N72-27925
N72-27926
N72-27927
N72-27928
N72-27929
N72-27930
RAPOPORT, I. D. N72-27832
RASBERRY, S. D. N72-27209
RAY, R. M. N72-27420
REAM, L. W. N72-27529
REAMES, D. V. N72-27833
REED, E. I. N72-27423
REINHOLD, P. N72-27035
RENY, H. R. N72-27339
REPLOGLE, C. R. N72-27094
RESHOTKO, M. N72-27030
REYES, A. I. N72-27077
REYNOLDS, P. A. N72-27279
RHEINBOLDT, W. C. N72-27206
RHOADES, T. S. N72-27711
RHOADS, D. J. N72-27038
RHODE, R. P. N72-27136
RHODEN, R. A. N72-27098
RIBON, M. N72-27413
RICHARDSON, H. T. N72-27494
RIEGEL, P. S. N72-27116
RIEGGER, S. N72-27562
N72-27942
RINALDI, R. N72-27073
RINGLAND, R. F. N72-27032
RITMAN, E. L. N72-27078
RITZMAN, R. L. N72-27478
RIVES, J. E. N72-27800
ROBERTS, B. W. N72-27790
ROBERTS, F. S. N72-27618
ROBERTS, R. N72-27067
ROBINSON, C. D. N72-27475
ROCHOW, S. E. N72-27144
N72-27151
ROESNER, K. G. N72-27307
ROHDE, W. G. N72-27375
ROKOTYAN, S. E. N72-27489
ROM, J. N72-27320
ROMERO, M. N72-27455
ROSALES, L. A. N72-27589
ROSCOE, S. N. N72-27085
ROSE, D. J. N72-27085
ROSENBERG, N. N72-27546
ROSS, J. E. R. N72-27843
ROSS, W. D. N72-27166
ROSSI, R. C. N72-27609
ROTHMULLER, I. J. N72-27714
ROUSCILLES, A. N72-27464
ROWE, W. L. N72-27675
ROWLAN, D. E. N72-27011
ROWLAND, J. R. N72-27223
ROZHETSKIY, S. Y. N72-27696
RUBIN, N. N. N72-27048
RUDNITSKIY, L. S. N72-27583
RUHNKE, L. H. N72-27431
RUQUIST, R. D. N72-27193
RUSNAK, R. M. N72-27819
RUTKOVSKIY, V. A. N72-27337
RYERSON, C. M. N72-27515
RYKALIN, N. N. N72-27533

S

SAFRONOVA, U. I. N72-27752
N72-27753
N72-27754
SAGALEVICH, E. A. N72-27569
SAISSE, M. N72-27453
SAITO, T. N72-27269
SAKAI, S. N72-27762
SALAS, M. D. N72-27300
N72-27303
SAMELSON, H. N72-27554
SAMYGIN, V. D. N72-27558
SANDERS, D. C. N72-27080
SANO, M. N72-27953
SASS, D. J. N72-27078
SATEHLE, R. W. N72-27590
SATO, M. N72-27141
SATTLER, H. P. N72-27557
SAVCHENKO, I. S. N72-27254
SAVENKO, I. A. N72-27832
SAVUN, O. I. N72-27355
SAWYER, R. H. N72-27010
SAX, R. L. N72-27393
SAZONOV, B. I. N72-27830
SCHAEFER, W. N72-27414
SCHEIFELE, G. N72-27625
SCHERER, M. N72-27371
SCHERRER, P. H. N72-27370
SCHIFFNER, G. N72-27548
SCHLIVE, J. N72-27955
SCHILLER, H. N72-27229
SCHINKER, M. N72-27603
SCHLADITZ, H. J. N72-27555
SCHLOSSER, F. N72-27323
SCHMADEBECK, R. N72-27880
SCHMIDT, D. N72-27556
SCHMITT, G. A. N72-27887
SCHMITZ, K. N72-27483
SCHNELLE, F. N72-27635
SCHOENAUER, W. N72-27314
SCHOLZE, H. N72-27595
SCHOUMACHER, P. N72-27148
SCHRADER, J. H. N72-27703
SCHULTZ, D. N72-27334
SCHULTZ, H. D. N72-27935
SCHULZ, M. N72-27405
SCHULZE, B. R. N72-27137
SCHWANZER, W. N72-27741
SCIBBE, H. W. N72-27528
SCRIBNER, W. G. N72-27166
SEAL, J. C. N72-27279
SEKAS, N. N72-27029
SEKINE, S. N72-27822
N72-27823
SELLEN, J. M. N72-27771
SEMENOV, B. N. N72-27315
SEMPLE, R. D. N72-27069
SENEKER, W. P. N72-27196
N72-27197
N72-27198
N72-27199
N72-27200
SERSON, P. H. N72-27415
SHANINIAN, P. N72-27726
SHANKAR, N. K. N72-27411
SHANTUAROV, R. S. N72-27612
SHAVRIN, P. I. N72-27355
SHIBUYA, A. N72-27027
SHILAKADZE, M. E. N72-27538
SHILOV, V. M. N72-27074
SHIPMAN, H. L. N72-27842
SHITZER, A. N72-27084
N72-27124
SHKOLNIKOV, V. A. N72-27379
SHLOSINGER, A. P. N72-27122
SHLYAPOCHNIK, L. Y. N72-27617
SHOCKEY, D. A. N72-27956
SHPAK, M. T. N72-27551
SHUKHMAN, I. G. N72-27751
SIDI, M. N72-27253
SIDORIN, I. I. N72-27581
SIEGEL, A. I. N72-27138
SIGRIST, N. N72-27625
SIKANOVA, K. M. N72-27342
SIKDAR, D. N. N72-27648
SILVER, E. A. N72-27392
SIMAC, J. J. N72-27738
SIMON, F. F. N72-27291
SIMON, M. N72-27247
SIMONETT, D. S. N72-27422
SIMS, D. N72-27602
SIMS, J. L. N72-27273
SINHA, A. K. N72-27364
SIROTA, N. N. N72-27805
SIROU, F. N72-27467
SKLIZKOV, G. V. N72-27160
SKODA, Z. N72-27329
SLONOVSKII, N. V. N72-27582
SLYKER, C. E. N72-27139
SMALL, R. D. N72-27320
SMEDES, H. W. N72-27352
SMEETS, G. N72-27324
SMILES, K. A. N72-27094
SMIT, G. R. N72-27383
SMITH, C. L. N72-27015
SMITH, D. L. N72-27002
SMITH, D. W. N72-27509
SMITH, E. N72-27647
SMITH, H. H. N72-27726
SMITH, J. R. N72-27368
SMITH, P. L. N72-27479
SMITH, R. G. N72-27069
SMITH, W. J., JR. N72-27388
SMOLDEREN, J. J. N72-27293
N72-27294
SMUTKINA, Z. S. N72-27142
SOBOLEV, E. A. N72-27572
SODERMAN, P. T. N72-27031
SOMMER, A. W. N72-27589
N72-27593
SORRENTINO, A. N72-27440
SOUFFLOT, A. N72-27449
SPEIRS, A. N72-27505
SPENCER, J. N72-27618
SPENCER, R. L. N72-27421
SPETH, P. N72-27636
SPIESS, F. N. N72-27404
SPRINGER, C. E. N72-27748
SPYERS-DURAN, P. N72-27644
STAGG, B. N72-27158
STAHLSCHMIDT, W. N72-27794
STAPLEFORD, R. L. N72-27032
STASSINOPOULOS, E. G. N72-27357
STAVA, D. J. N72-27018
STEELE, F. K. N72-27202
STEEN, P. J. N72-27168
STELLE, L. E. N72-27726
STEUERNAGEL, W. H. N72-27242
STEWART, W. N. N72-27211
STIEFEL, E. N72-27625
STIRTON, R. J. N72-27654
STOCHL, R. J. N72-27966
STOERTZ, G. E. N72-27149
N72-27351
N72-27353
STOKOE, A. L. N72-27602
STONE, D. R. N72-27312
STONE, J. R. N72-27012
STRAIT, B. J. N72-27190
STRAITON, A. W. N72-27174
STRELOV, A. V. N72-27587
STREMIER, F. G. N72-27650
STRIKE, W. T. N72-27924
N72-27925
N72-27926
N72-27927
N72-27928
N72-27929
N72-27930
STROM, T. N. N72-27522
STRONG, A. E. N72-27362
STUEWE, H. P. N72-27571
STUMP, E. C., JR. N72-27144
N72-27151
SU, M. Y. N72-27204
SUGIMOTO, S. N72-27319
SUMMERFIELD, D. G. N72-27272
SUMMITT, J. K. N72-27088
SUOMI, V. E. N72-27646
SURBER, L. E. N72-27018
SUTTON, J. G. N72-27113
SUZUKI, K. N72-27560
SVIRIDOVA, R. N. N72-27605
SWANSON, E. R. N72-27714
SWEARINGEN, J. J. N72-27011
SWEETLAND, K. F. N72-27127
SWOBODA, K. N72-27556

T

TABARROK, B. N72-27954
TAKAHASHI, T. N72-27619
TAKANO, K. N72-27269
TAKASAWA, K. N72-27028
TAKIMOTO, H. H. N72-27163
TAKIZAWA, N. N72-27027
TAMM, P. U. N72-27241
TANABE, Y. N72-27027
TANNER, C. S. N72-27050
TARAKANOV, R. Z. N72-27399
TARASOV, M. N. N72-27270
TAUSWORTHE, R. C. N72-27249
TAYLOR, R. J. N72-27771
TEMAN, R. N72-27296
TEMIN, R. N72-27297
TEPPER, E. H. N72-27113
TERRY, R. N72-27345
TESHIMA, K. N72-27772

TESSIER, R. N72-27381
TEYTU, A. *N72-27715*
THOMAS, J. R. N72-27866
THOMAS, R. N72-27148
THOMSON, G. W. N72-27406
THORNE, R. M. N72-27868
TIKHONOV, A. S. N72-27568
TIKHONOV, E. A. N72-27551
TILLYASHAIKHOVA, R. N72-27657
TITHER, G. N72-27545
TKACHENKO, V. M. N72-27780
TOLMACHEV, V. V. N72-27752
N72-27753
N72-27754
TONETTI, B. B. N72-27920
TONNA, G. *N72-27642*
TORISAKI, T. N72-27822
N72-27823
N72-27584
TRABOCCO, R. E. N72-27856
TRAINOR, J. H. N72-27598
TRAP, H. J. L. N72-27217
TREU, S. N72-27211
TREVATHAN, C. N72-27504
TRILLWOOD, R. E. N72-27924
TRIMMER, L. L. N72-27925
N72-27926
N72-27927
N72-27928
N72-27929
N72-27930
TROMBKA, J. N72-27880
TROSHIN, Y. K. N72-27961
TROWBRIDGE, C. A. N72-27482
TSAPLIN, V. S. N72-27839
TSEMEL, G. I. N72-27210
TSULJI, T. N72-27949
TSUKAMOTO, A. N72-27275
TSYBAKOV, B. S. N72-27207
TULLY, P. C. N72-27155
TUMA, H. N72-27561
TUNG, P. P. N72-27593
TUNG, Y. N72-27102
TYLER, D. M. N72-27089
TYURMIN, A. V. N72-27354

U

UENAKADA, K. N72-27269
UGLOV, A. A. N72-27533
UHDE, A. N72-27325
UHR, L. N72-27208
UMANSKII, Y. S. N72-27587
URSUL, A. D. N72-27179
USUI, H. N72-27427

V

VAERMAN, J. N72-27960
VANALLEN, J. A. N72-27835
N72-27871
VANBEEK, G. J. N72-27339
VANDERKOLK, R. J. N72-27085
VANDERKRAAN, A. M. N72-27793
VANDERLIND, M. R. N72-27478
VANDERZIEL, A. N72-27243
VANDOLAH, R. W. N72-27107
VANDORN, W. G. N72-27773
VANHEMELRIJCK, E. N72-27774
VANKEUK, G. N72-27775
VARHOLAK, E. M. N72-27866
VASOV, N. G. N72-27148
VEDDER, J. G. N72-27406
VELENOV, E. M. N72-27868
VERSHININA, L. K. N72-27568
VERSHOK, B. A. N72-27551
VESELOVSKIJ, N. V. N72-27657
VESSOT, R. F. C. N72-27545
VIAL, J. C. N72-27780
VIDAL, S. N72-27752
VIEWING, K. A. N72-27753
VIGOUREUX, P. N72-27754
VILLELLA, F. N72-27920
VINCIARELLI, P. *N72-27642*
VISWANATHAN, M. M. N72-27822
VOEHRINGER, O. N72-27823
N72-27584
VOLCHOK, H. L. N72-27856
VOLOSHIN, V. G. N72-27598
VONDERWEYDEN, H. D. N72-27217
VONGIERKE, H. E. N72-27211
VONGLAHN, U. N72-27504
VONRITTBERG, G. N72-27924
VONSCHLACHTA, K. N72-27925
N72-27926
VORONTSEV, V. K. N72-27927
VOSKRESENSKIY, D. I. N72-27928
N72-27929
N72-27930

W

WAAG, W. L. N72-27961
WAIKAR, V. B. N72-27482
WALLACE, J. F. N72-27839
WALLACE, T. F. N72-27210
WALLIS, A. L. N72-27949
WALLNER, F. N72-27275
WALSER, R. M. N72-27207
WALTZ, F. A. N72-27155
WARD, J. M. N72-27561
WARE, W. H. N72-27593
WARFIELD, J. T. N72-27102
WARWICK, J. N72-27089
WATSON, H. E. N72-27354
WATSON, J. S.
WEDLER, G.
WEGENER, H. A. R.
WEHBY, A. J.
WEIGAND, A. J. N72-27269
WEINSTEIN, B. N72-27533
WEISS, D. N72-27325
WELNER, V. W. N72-27208
WENDT, J. F. N72-27587
WERLE, D. K. N72-27179
WERNICKE, J. N72-27427
WESSING, W.
WEST, G.
WESTERHEIDE, D. E.
WESTIN, H.
WESTLAKE, G. E. N72-27960
WHEELER, R. N72-27835
WHIPPLE, D. W. N72-27871
WHITACRE, J. N72-27339
WHITE, K. J. N72-27085
WHITE, R. B. N72-27793
N72-27478
WHITE, T. L. N72-27243
WHYTE, R. B. N72-27107
WILCOX, D. E. N72-27404
WILCOX, J. M. N72-27372
N72-27181
WILCOX, W. R. N72-27182
WILL, C. M. *N72-27184*
WILLIAMS, B. A. N72-27047
WILLIAMS, J. G. N72-27547
WILLIAMS, J. L. N72-27390
WILSON, T. G. N72-27547
WILTSHIRE, R. S. N72-27662
N72-27787
WIMSATT, J. C. N72-27270
WINKLER, S. R. N72-27363
WINN, L. E. N72-27457
WINTER, W. R. N72-27449
WIRTH, W. D. N72-27367
N72-27525
N72-27521
WISE, S. N72-27767
WISSMANN, P. N72-27082
WLODYKA, R. A. N72-27562
WNEK, W. J. N72-27942
WOJTASINSKI, R. J. N72-27724
WOLF, J. J. N72-27658
WOLF, M. J. N72-27716
WOLFF, S. N72-27093
WOLLIN, H. F. N72-27029
WOOD, E. H. N72-27576
WOOD, R. C. N72-27185
WOODBURY, P. W. N72-27186
WOODLEY, C. C. N72-27615
WOODS, J. M. N72-27175
WRIGHT, T. L.
WU, S. N72-27089
WYDEVEN, T. N72-27626
N72-27575

Y

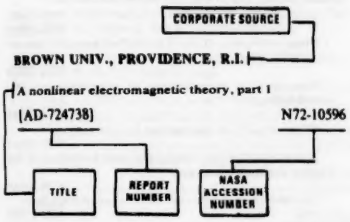
YABLONOVSKAYA, R. R. N72-27011
YAKOWITZ, H. N72-27282
YAMADA, H. N72-27508
YAMPOLSKIY, R. I. N72-27798
YANKOVICH, D. N72-27368
YARBOROUGH, J. M. N72-27375
YARIN, L. P. N72-27212
YASUNAGA, K. N72-27727
YEH, Y. N72-27851
YIN, L. N72-27726
YONAIYAMA, M. N72-27885
YONG, K. N72-27789
YOUNG, K. N72-27250
YOUNG, L. R. N72-27077
YURA, H. T. N72-27825
N72-27700
N72-27051
N72-27043
N72-27327
N72-27162

Z

ZAGALSKY, N. R. N72-27532
ZAKHAROV, S. M. N72-27708
ZARETSKY, E. V. N72-27487
ZELLER, S. S. N72-27105
ZHADEN, V. T. N72-27718
ZHUKHOVITSKII, A. A. N72-27384
ZHURAVLEV, D. A. N72-27091
ZIV, M. N72-27094
N72-27485
ZONARS, D. N72-27403
ZUERNDORFER, H. N72-27164
ZUEV, I. V. N72-27347
ZURINSKAS, T. E. N72-27770
ZUSMAN, F. S. N72-27848
ZVEREV, G. I. N72-27811
N72-27015
N72-27370
N72-27834
N72-27807
N72-27358
N72-27126
N72-27784
N72-27114
N72-27230
N72-27933
N72-27934
N72-27077
N72-27956
N72-27102
N72-27121
N72-27183
N72-27185
N72-27187
N72-27498
N72-27789
N72-27664
N72-27162
N72-27234
N72-27138
N72-27059
N72-27794
N72-27975
N72-27078
N72-27424
N72-27541
N72-27510
N72-27063
N72-27366
N72-27068
N72-27131
N72-27563
N72-27209
N72-27429
N72-27254
N72-27128
N72-27747
N72-27970
N72-27269
N72-27677
N72-27880
N72-27948
N72-27844
N72-27643
N72-27090
N72-27746
N72-27713
N72-27160
N72-27573
N72-27115
N72-27787
N72-27145
N72-27832
N72-27176
N72-27951
N72-27022
N72-27693
N72-27533
N72-27702
N72-27168
N72-27254

CORPORATE SOURCE INDEX

TYPICAL CORPORATE SOURCE INDEX LISTING



Listings in this index are arranged alphabetically by corporate source. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The NASA accession number denotes the number by which the citation is identified. The titles are arranged under each corporate source in ascending accession number order.

A

ACCUMETRICS CORP., CAMBRIDGE, MASS.
Development of a sensitive triaxial piezoelectric accelerometer
[AD-739202] N72-27473

ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT, PARIS [FRANCE].
Airframe/engine integration
[AGARD-LS-53] N72-27016
Numerical methods in fluid dynamics
[AGARD-LS-48] N72-27293
Guidance and control of tactical missiles
[AGARD-LS-52] N72-27681
Technical program, 1973
[AGARD-BULL-72-2] N72-27976

AERONAUTICA MILITARE ITALIANA, ROME.
Compilation of the 1970 annual data from measurements of the total beta activity determined from atmospheric dust samples collected in Italy by AM-CNR ground station network
N72-27653

AERONAUTICAL RESEARCH COUNCIL [ENGLAND].
Technical Report for the year 1958. Volume 1: Research on aerodynamics, aerodynamic heating, and airfoils
[SBN-11-470151-2] N72-26993
Technical Report for the year 1958. Volume 2: Research on aircraft, boundary layers, compressors and turbines, and flutter and oscillations
[SBN-11-470152-0] N72-26994
Technical Report for the year 1958. Volume 3: Research on guided weapon systems, wind tunnels, VTOL, aircraft, seaplanes, and related aeronautical topics
[SBN-11-470153-9] N72-26995

AERONAUTICAL RESEARCH LABS., MELBOURNE [AUSTRALIA].
Transonic wind tunnel tests of a dual system [vanes, pressure taps] gust probe and a pitot-static probe mounted side by side
[ARL/A-NOTE-334] N72-27426
The effect of interfacial carbide formation on fibre-strengthening in carbon-aluminium composites
[ARL/MET-87] N72-27601

AERONAUTICAL SYSTEMS DIV., WRIGHT-PATTERSON AFB, OHIO.
Self-contained guidance technology
N72-27690
Application of inertial technology to A-G missiles
N72-27691

AEROSPACE CORP., EL SEGUNDO, CALIF.
Vacuum thermal decompositions of the nitrate salts of hydrazine
[AD-739187] N72-27163
Cross sections for emission of Lyman alpha radiation in collisions of 1-25 keV protons and hydrogen atoms with Constituents of planetary atmospheres
[AD-739184] N72-27395
Transient structure of an artificial radiation belt
[AD-739495] N72-27405
Construction and operation of an improved ice calorimeter
[AD-739186] N72-27475
A new technique for estimating the modulation transfer function of an imaging system from its edge response
[AD-739550] N72-27479
The application of a fracture mechanics theory to thermal shock resistance of brittle materials
[AD-739494] N72-27609
Photoemission from polymers
[AD-739498] N72-27610
Effect of satellite orbital perturbations on the proposed gyroscope test of general relativity
[AD-739500] N72-27712
First and second moments of an optical wave propagating in a random medium: Equivalence of the solution of the Dyson and Bethe-Salpeter equation to that obtained by the Huygens-Fresnel principle
[AD-739185] N72-27746
The observations of SAR arcs from the OV1-10 satellite
[AD-737544] N72-27902
Techniques for generating a real world ephemeris
[AD-739492] N72-27940

AEROSPACE MEDICAL RESEARCH LABS., WRIGHT-PATTERSON AFB, OHIO.
The effects of high intensity noise on human equilibrium
[AD-737826] N72-27093
Analysis of the vestibulo-ocular counterroll reflex in primates
[AD-737828] N72-27094
Symposium on Biodynamic Models and Their Applications
[AD-739501] N72-27140

AEROSPACE RESEARCH LABS., WRIGHT-PATTERSON AFB, OHIO.
Similar solutions of the three dimensional boundary layer with constant cross flow
[AD-739864] N72-27335
Tables for the extreme roots of the Wishart matrix
[AD-739518] N72-27626
Supersonic mixing and combustion of coaxial hydrogen-air streams in a duct
[AD-739866] N72-27971

AGRICULTURE DEPT., BERKELEY, CALIF.
Remote sensing of changes in morphology and physiology of trees under stress
[NASA-CR-127420] N72-27375

AIR FORCE AERO PROPULSION LAB., WRIGHT-PATTERSON AFB, OHIO.
The time of flight spectrometer data reduction techniques
[AD-739189] N72-27827

AIR FORCE CAMBRIDGE RESEARCH LABS., L. G. HANSCOM FIELD, MASS.
Neutral composition measurements of the mesosphere and lower thermosphere
[AD-739169] N72-27664
Frequency model for the GI-T1-B single degree of freedom rate integrating gyroscope
[AD-739182] N72-27711
Solar microwave bursts as indicators of the occurrence of solar proton emission
[AD-738287] N72-27840

AIR FORCE FLIGHT DYNAMICS LAB., WRIGHT-PATTERSON AFB, OHIO.
Inlet/airplane interference and integration
N72-27018
Dynamic characteristics of engine inlets
N72-27022
A computerized procedure to obtain the coordinates and section characteristics of NACA designated airfoils
[AD-738623] N72-27332

AIR FORCE SYSTEMS COMMAND, WRIGHT-PATTERSON AFB, OHIO.
Sealed cadmium-nickel batteries
[AD-739211] N72-27068
Thermophysical properties of gases, selected articles
[AD-738737] N72-27161
Low-capacity microwave communication links
[AD-738694] N72-27191
Removing the defect in a differential bus protection circuit
[AD-739213] N72-27237
The megampere accelerator
[AD-739294] N72-27281
Determining the extent of the transition zone and the rules for heat transfer in it with mixed air flow in pipes
[AD-739210] N72-27328
Influence of mixing of a jet with the surrounding air upon a profile with a jet flap
[AD-739205] N72-27329
An approximate method for calculating the minimum suction rate that excludes separation for the boundary layer of a semi-bounded stream
[AD-739222] N72-27330
Empirical formulas for aerodynamic coefficients of blunted cones in a rarefied gas
[AD-739214] N72-27331
The resistance of pyramidal bodies in the supersonic flow
[AD-739293] N72-27333
Calibrating PR 30/6 thermocouples up to 1800 C
[AD-738748] N72-27474
Dagger fusion of metals with an electron beam
[AD-739289] N72-27533
Testing cast iron-hardened steel friction pairs
[AD-739278] N72-27534
The effect of vibration frequency on static friction
[AD-739279] N72-27535
Precision electron beam welding and equipment
[AD-739282] N72-27536
Analysis of the operating conditions of gas turbine rotor bearings from an electronic computer calculation of their thermal regime
[AD-739209] N72-27537
Question of experimentally determining certain parameters for the durability of slide bearings with bushings made of plastic
[AD-739212] N72-27538
Calculating the wear intensity of graphite bearings which work under lubrication conditions with aggressive liquids
[AD-738746] N72-27539
Wear resistance of tool steels and its dependence on the elements in martensite and carbides
[AD-739276] N72-27581
The problem of the dependence of wear resistance of metals during abrasive wear on their physicomechanical properties
[AD-739277] N72-27582
The increase in wear resistance of chrome-nickel cast irons by means of alloying by niobium
[AD-739285] N72-27583
Thermal conductivity of chiatura manganese concentrates and their pelletized products
[AD-739215] N72-27585
Plotting isothermal diagrams by an X-ray diffraction method
[AD-739219] N72-27586
Diffuse scattering of X-rays by a solid solution
[AD-739226] N72-27587
X-ray study of the thermal expansion of nickel-chromium alloys
[AD-739301] N72-27588
About the forming of the structure of pyrolytic carbonic fibers
[AD-739284] N72-27605
Effect of diamond burnishing on the quality of chromium coatings
[AD-739206] N72-27607
One method of solving equations of hydrothermodynamics
[AD-739239] N72-27657
The question of the connection between the turbulence coefficient and temperature and wind distribution in the lower 300 meter layer
[AD-739221] N72-27658
Meteorological satellites and the weather services
[AD-739291] N72-27665
Installation for studying the electric breakdown mechanism of an ultrahigh vacuum
[AD-739280] N72-27743

Studies of the phenomena of material transfer from electrodes during high-vacuum pulse breakdown
[AD-739208] N72-27744
Certain characteristics of discharge in a nonuniform and transverse magnetic field
[AD-739290] N72-27780
Phenomena of transfer in low-temperature plasma [selected articles]
[AD-738739] N72-27781
Evaluation of the Lorentz number in semiconductors
[AD-739245] N72-27802
Certain technical possibilities of photocells based on beta-SiC
[AD-739223] N72-27803
The effect of irradiation by gamma rays on the first constant of magnetic crystallographic anisotropy of single crystals of nickel and nickel-copper ferrites
[AD-739286] N72-27805
Lunokhod: A new step in space exploration
[AD-738683] N72-27938
Soviet robot on the Sea of Rains
[AD-738681] N72-27939
The question of burning in turbuient flow
[AD-739292] N72-27970

AIRBORNE INSTRUMENTS LAB., DEER PARK, N.Y.
Evaluation of the 1968 FAA/DOD Beacon flight test in New York
[AD-738680] N72-27709

AIRCRAFT RESEARCH ASSOCIATION, LTD., BEDFORD [ENGLAND].
Experimental determination of inlet characteristics and inlet and airframe interference
N72-27019

AIRESEARCH MFG. CO., LOS ANGELES, CALIF.
Preliminary design of an auxiliary power unit for the space shuttle. Volume 3: Details of system analysis, engineering, and design for selected system
[NASA-CR-1995] N72-27054
Preliminary design of an auxiliary power unit for the space shuttle. Volume 4: Selected system supporting studies
[NASA-CR-1996] N72-27064

APPLIED PSYCHOLOGICAL SERVICES, WAYNE, PA.
Modification of the Siegel-Wolf operator simulator model for on-line experimentation
[AD-737798] N72-27138

ARIZONA UNIV., TUCSON.
Groundbased infrared observations of celestial sources
[AD-739196] N72-27901

ARMY ELECTRONICS COMMAND, FORT MONMOUTH, N.J.
Investigations on organic electrolyte lithium-C[x]F cells
[AD-739488] N72-27071
Experimental study of germanium cell performance with erbium oxide and silicon carbide radiators
[AD-739489] N72-27072
Engineering evaluation of nonreserve zinc air cells
[AD-739490] N72-27073
Time and space resolved measurement of the gas temperature and its decay in afterglow discharges
[AD-739491] N72-27783

ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER, CHARLOTTESVILLE, VA.
Antiaircraft defense herald, number 8, August 1971
[AD-739229] N72-27988
Antiaircraft defense herald, number 7, July 1971
[AD-739973] N72-27990
Antiaircraft defense herald, number 10, October 1971
[AD-739974] N72-27991

ARMY MISSILE COMMAND, REDSTONE ARSENAL, ALA.
Pulse compression side-lobe clutter reduction
[AD-739512] N72-27195
Statistical analysis techniques for error propagation in large-scale missile systems
[AD-739513] N72-27223
A preliminary study of disturbance absorbing controllers for servomechanism problems
[AD-739503] N72-27260
Missile system coating
[AD-739504] N72-27989

ARMY TOPOGRAPHIC COMMAND, WASHINGTON, D.C.
An annotated bibliography of remote sensing of air and water pollution
[AD-737588] N72-27406
An investigation of methods for estimating gravity anomalies and their application to height difference determination
[AD-737589] N72-27541

ARMY WEAPONS COMMAND, ROCK ISLAND, ILL.
Effect of strain rate on the mechanical properties of Cr-Mo-V steel at elevated temperatures
[AD-739516] N72-27591

ARO, INC., ARNOLD AIR FORCE STATION, TENN.
Evaluation of the Thiokol TE-T-607-1 motor at simulated altitude conditions
[AD-739191] N72-27828

ARTECH CORP., FALLS CHURCH, VA.
Research on whisker-reinforced metal composites
[AD-736973] N72-27608

ATLANTIC RESEARCH CORP., ALEXANDRIA, VA.
IPP-1 user manual. Volume 1, part 1
[AD-739526] N72-27196
IPP-1 user manual. Volume 1, part 2
[AD-739527] N72-27197
IPP-1 user manual. Volume 2, part 1
[AD-739528] N72-27198
IPP-1 user's manual. Volume 2, part 2
[AD-739529] N72-27199
IPP-1 user manual. Volume 2, part 3
[AD-739530] N72-27200

ATMOSPHERIC SCIENCES LAB., WHITE SANDS MISSILE RANGE, N.MEX.
Fog dissipation techniques for emergency use
[AD-739487] N72-27042
Wind tunnel simulation and prototype studies of barrier flow phenomena
[AD-739484] N72-27282
Atmospheric tidal measurements at 50 Km from a constant-altitude balloon
[AD-739486] N72-27403
Weather radar investigations on an artillery test conducted in the Panama Canal Zone
[AD-739485] N72-27666

ATOMIC ENERGY COMMISSION, NEW YORK.
Global inventory and distribution of Pu-238 from SNAP-9A
[HASL-250] N72-27724

ATOMIC ENERGY COMMISSION, WASHINGTON, D.C.
Environmental statement, reactor testing, FY 1972 Nuclear Rocket Development Station Nevada
[NASA-TM-X-68555] N72-27268

B

BABCOCK AND WILCOX LTD., LONDON [ENGLAND].
High integrity tube-to-tubeplate bore welds
N72-27505

BALLISTIC RESEARCH LABS., ABERDEEN PROVING GROUND, MD.
The influence of the magnus moment on the dynamic stability of a projectile
[AD-738016] N72-27005
A simple technique for generating nitrogen atoms
[AD-739520] N72-27164

BATTELLE MEMORIAL INST., COLUMBUS, OHIO.
Investigation of the applicability of the free-wing principle to light, general aviation aircraft
[NASA-CR-2046] N72-26996
Semiclosed-circuit atmosphere control in a portable recompression chamber
N72-27116
Use of kryptonates as a surface temperature measurement technique
[AD-739372] N72-27478

BAYLOR UNIV., HOUSTON, TEX.
Compressible biomedical electrode
[NASA-CASE-MSC-13648] N72-27103

BENDIX CORP., MADISON HEIGHTS, MICH.
Oxidation resistant porous material for transpiration cooled vanes
[NASA-CR-1999] N72-27819

BISSETT-BERMAN CORP., SAN DIEGO, CALIF.
Automatic capacitance measuring system
[AD-739556] N72-27480

BOEING CO., PHILADELPHIA, PA.
Secondary power system study for advanced rotary wing aircraft
[AD-739480] N72-27069

BOEING CO., SEATTLE, WASH.
Computational methods for inviscid transonic flows with imbedded shock waves
N72-27306
Development of control system requirements
N72-27683
Guidance law applicability for missile closing
N72-27689
Calculation of neutron-decay-proton trapping in the Jovian magnetosphere
N72-27866

BOEING SCIENTIFIC RESEARCH LABS., SEATTLE, WASH.
Wave propagation in the magnetosphere of Jupiter
N72-27869

BREST UNIV. [FRANCE].
Global calculations of concave grating aberrations and optimization of resolution with regard to luminosity
N72-27450

BRITISH STEEL CORP., LONDON [ENGLAND].
Magnetohydrodynamics in casting processes
[PB-207429] N72-27544
Improved properties by direct quenching
[PB-207425] N72-27545

BROWN UNIV., PROVIDENCE, R.I.
A crack extending non-uniformly in an elastic solid subjected to general loading
[AD-739557] N72-27957

BUREAU OF MINES, AMARILLO, TEX.
Helium: Bibliography of technical and scientific literature, 1965, including papers on alpha-particles
[BM-IC-8523] N72-27155

BUREAU OF MINES, BARTLESVILLE, OKLA.
A chemiluminescence detector for ozone measurement
[BM-RI-7650] N72-27420

BUREAU OF MINES, PITTSBURGH, PA.
Portable breathing apparatus for coal mines
N72-27107

C

CALIFORNIA INST. OF TECH., PASADENA.
A small perturbation theory for cycloidal propellers
N72-27285
Propagation of 1-10 MeV solar flare protons in interplanetary space
N72-27829
Nonspherical perturbations of relativistic gravitational collapse
N72-27841
White dwarfs: A dissertation in astronomy
N72-27842
Some recent observations and interpretation of the Jupiter decimeter emission
N72-27861
Comments on models of the Jovian radiation belts
N72-27874

CALIFORNIA UNIV., BERKELEY.
Remote sensing of changes in morphology and physiology of trees under stress
[NASA-CR-127420] N72-27375

CALIFORNIA UNIV., LOS ANGELES.
The use of the three dimensional coherency matrix in analyzing the polarization properties of plane waves
[NASA-CR-127271] N72-27167
Computer network research
[AD-739705] N72-27225
Electrostatic instability of ring current protons beyond the plasmapause during injection events
[NASA CR-122447] N72-27347
Structure of ion acoustic solitons and shock waves in a two component plasma
[NASA-CR-127387] N72-27770
Cross field current driven ion acoustic instability
[NASA-CR-127272] N72-27771
The solar abundance of iron
N72-27843
Stably trapped proton limits for Jupiter
N72-27867
A self-consistent model for Jupiter's radiation belts
N72-27868

CALIFORNIA UNIV., SAN DIEGO.
Broad band accelerometers and their deployment for seismic studies
[AD-739975] N72-27481
Markov processes and related topics
[AD-739983] N72-27629

CALIFORNIA UNIV., SANTA BARBARA.
On optimizing the treatment of exchange perturbations
[NASA-CR-127265] N72-27154

CAMBRIDGE UNIV. [ENGLAND].
Pressure distributions at M sub infinity = 3.51 and at high incidences on four wings with delta planform
[ARC-CP-1198] N72-27004
Application of finite element methods in fluid dynamics
N72-27305
Effect of welding on compression elements
N72-27500

CARNEGIE-MELLON UNIV., PITTSBURGH, PA.
Optimal control strategies for air quality standards and regulatory policy
[PB-207976] N72-27670
On the numerical determination of optimal control strategies for air quality standards and regulatory policy
[PB-207975] N72-27671

CASE WESTERN RESERVE UNIV., CLEVELAND, OHIO.
The effect of alloying on gamma and gamma prime in nickel-base superalloys
[NASA-CR-120940] N72-27575

CENTRAL ELECTRICITY GENERATING BOARD, BERKELEY [ENGLAND].
The role of research and development with particular reference to high temperature welded structures
N72-27493

CENTRAL ELECTRICITY GENERATING BOARD, LONDON [ENGLAND].
Jet impingement and diffusion, 1961 - 1971
[CE-BIBL-224] N72-27321

CENTRE D'ETUDE SPATIALE DES RAYONNEMENTS, TOULOUSE [FRANCE].
Dynamic behavior of electrons: Effect of the deformation of the magnetic field
[ESRO-SN-117] N72-27382
The use of channeltron in the far ultraviolet
N72-27441

CENTRE NATIONAL D'ETUDES SPATIALES, BRETIGNY-SUR-ORGE [FRANCE].
Preprocessing of Meteosat images: Measurement of the geometric quality of the image
N72-27469

CENTRE NATIONAL D'ETUDES SPATIALES, PARIS [FRANCE].
Proceedings of the third conference on space optics
N72-27435
Correction of the optical surface by vacuum deposition
N72-27454
CENTRE NATIONAL D'ETUDES SPATIALES, TOULOUSE [FRANCE].
Coded pointing system star sensor for use onboard a spinning satellite
N72-27459
Choice of parameters for the Meteosat radiometer
N72-27466
CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, BELLEVUE [FRANCE].
Onboard mechanical scanning infrared radiometer for the 10.5 to 12.5 micron range
N72-27467
CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, MARSEILLES [FRANCE].
TELERS: Remote sensing and studies of earth resources. Experiment proposal for advanced applications flight experiments [AAFFEE]
N72-27386
Use of Kerber profile Schmidt plates with different optical systems
N72-27453
Directive diffusers
N72-27465
CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, VERRIERES-LE-BUISSON [FRANCE].
A new high performance liquid helium cooled bolometer for far infrared range
N72-27438
Physical limitations of image tubes for space applications
N72-27444
The holographic grating of the D2A polar satellite Lyman beta experiment
N72-27449
Design and development of multichannel spectrometer onboard the OSO-1 satellite
N72-27457
Hyperfrequency excitation generators
N72-27463
Ultraviolet fluorescence of single crystals: Application to continuous radiation
N72-27464
Optimization of image quality by analog computation
N72-27470
CHICAGO UNIV., ILL.
A diffusion model of rapid glaciation within supercooled clouds
[TN-42] N72-27643
Systematic measurements of cloud particle spectra in middle level clouds
[TN-43] N72-27644
Ice crystal terminal velocities
[NASA-CR-127428] N72-27645
Advanced technical developments in support of scientific experiments in space
[NASA-CR-127267] N72-27847
CHRYSLER CORP., NEW ORLEANS, LA.
Investigation of propulsion packages for the NASA/LaRC parametric delta wing orbiter
[NASA-CR-123722] N72-27923
Space shuttle abort separation pressure investigation. Volume 1, Part A: Booster data at Mach 5
[NASA-CR-120008-VOL-1-PT-A]
N72-27924
Space shuttle abort separation pressure investigation. Volume 1, Part B: Booster data at Mach 5
[NASA-CR-120008-VOL-1-PT-B]
N72-27925
Space shuttle abort separation pressure investigation. Volume 2, Part B: Orbiter data at Mach 5
[NASA-CR-120061] N72-27926
Space shuttle abort separation pressure investigation. Volume 3: Booster data at Mach 3
[NASA-CR-120062] N72-27927
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[NASA-CR-120063] N72-27928
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[NASA-CR-120064] N72-27929
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CORNELL UNIV., ITHACA, N.Y.
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N72-27865
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N72-27497
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N72-27893

D

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N72-27287
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[REPT-162] N72-27183
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[REPT-177] N72-27187
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N72-27118
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[NASA-CASE-MFS-21395-1] N72-27425
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[NBS-TN-724] N72-27790
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[NASA-CR-127252] N72-27220
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[NASA-CR-127253] N72-27706
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[NASA-CR-127531] N72-27352
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[NASA-CR-127257] N72-27149
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[NASA-CR-127528] N72-27351
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[NASA-CR-127529] N72-27353
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[AD-739869] N72-27051
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[RM-548] N72-27838
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[AD-739384] N72-27747

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HAMILTON STANDARD, WINDSOR LOCKS, CONN.
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[AD-739555] N72-27047
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N72-27109
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N72-27113
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[AD-739482] N72-27242
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N72-27128
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N72-27503
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N72-27854
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[NASA-CR-127270] N72-27345
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[BM-IC-8530] N72-27348
INTERNATIONAL BUSINESS MACHINES CORP., GAITHERSBURG, MD.
Breathing metabolic simulator
N72-27129
INTERNATIONAL BUSINESS MACHINES CORP., SAN JOSE, CALIF.
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N72-27299

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IOWA UNIV., IOWA CITY.
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[NASA-CR-127424] N72-27776
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[NASA-CR-127425] N72-27835
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N72-27853
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N72-27871
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[TT-70-50126] N72-27399
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[TT-70-50169] N72-27400
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[TT-70-50185] N72-27659
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[TT-70-50093] N72-27662
Actinometry and atmospheric optics
[TT-70-50159] N72-27663
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[TT-70-50179] N72-27745
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N72-27653

J

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[REPT-18] N72-27203
NHK Kinuta SHF experimental station
[REPT-150] N72-27269
JET PROPULSION LAB., CALIF. INST. OF TECH., PASADENA.
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[NASA-CR-127271] N72-27167
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[NASA-CR-127122] N72-27176
Uninsulated in-core thermionic diode
[NASA-CASE-NPO-10542] N72-27228
Third order phase locked loops
[NASA-CASE-NPO-11941-1] N72-27249
Digital canopus tracker digital electronics
[NASA-CR-127418] N72-27251
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[NASA-CR-127575] N72-27267
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[NASA-CR-127277] N72-27358
Preferred frame theories and an extended PPN formalism
N72-27359
Experimental evidence to rule out preferred frame theories of gravity
N72-27360
Audio frequency marker system
[NASA-CASE-NPO-11147] N72-27408
Light direction sensor
[NASA-CASE-NPO-11201] N72-27409
Adjustable support
[NASA-CASE-NPO-10721] N72-27484
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[NASA-CR-127124] N72-27850
Scientific and engineering analyses of Jupiter's energetic electrons and protons
N72-27855
Derivation of mission fluences from flux models: Propagation of uncertainties
N72-27857
Effects of electrons and protons on science instruments
N72-27858
Impact of Jovian radiation environmental hazard on spacecraft and mission development design
N72-27859
A note on the Gledhill model of the magnetosphere of Jupiter
N72-27862
Conclusion
N72-27873
Post-workshop models of Jupiter's radiation belts
N72-27875
Evaluation of electroexplosive devices by nondestructive test techniques and impulsive waveform firings
[NASA-CR-127255] N72-27964
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[JPRS-56424] N72-27003
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[JPRS-56385] N72-27175
Information and cybernetics
[JPRS-56465] N72-27179
Recognition of spoken signals
[JPRS-56370] N72-27210
Multitube generator bank
[JPRS-56371] N72-27254
Laminar multicomponent boundary layer with high rates of injection
[JPRS-56437] N72-27322
Austenitic-boride steels and alloys for welded structures
[JPRS-56406] N72-27578
Improving accuracy of gyroinstrumental control systems
[JPRS-56387] N72-27695
Error of an inertial navigation system designed on the basis of an azimuth gyrocompass
N72-27696
Feasibility of neglecting the small time constants of the control systems of a single-axis gyrostabilizer
N72-27697
Determining the direction of the meridian by means of an angular rate sensor
N72-27698
Experimental study of the dispersion of the magnetic field of a gyromotor
N72-27699
Navigational cybernetics of flight
[JPRS-56487] N72-27704
The "eyes" of an airport
[JPRS-56463] N72-27705
Translations on Eastern Europe - Scientific Affairs, no. 250
[JPRS-56289] N72-27733
Docking training and telemetry
[JPRS-56464] N72-27881
For a rendezvous in orbit
N72-27882
Over telemetry channels
N72-27883
Soviet bloc research in geophysics, astronomy, and space, no. 279
[JPRS-56398] N72-27884
Soviet-bloc research in geophysics, astronomy and space, no. 280
[JPRS-56444] N72-27890
Translations on eastern Europe - Scientific affairs, no. 256
[JPRS-56460] N72-27895
Translations on Eastern Europe - Scientific affairs, no. 254
[JPRS-56426] N72-27981
JOUAN-QUETIN JOBIN-YVON, LONGJUMEAU [FRANCE].
Recent developments in holographic networks and some applications
N72-27448

K

KANSAS UNIV., LAWRENCE.
On the use of space photography for identifying transportation routes: A summary of problems
[NASA-CR-127530] N72-27422
Discussion of the reliability of electron densities and energies interpreted from data and limits on the proton energy and density
N72-27863
KAWECKI BERYLCO INDUSTRIES, INC., READING, PA.
An electrolytic process for ultra fine beryllium
[NASA-CR-127427] N72-27577
KIRUNA GEOPHYSICAL OBSERVATORY [SWEDEN].
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[KGO-727] N72-27384
KYOTO UNIV. [JAPAN].
Studies on hypervelocity model launcher
[CP-34] N72-27275
Measurement of electron temperature along a stagnation-point stream line in a partially ionized gas
[CP-35] N72-27319
Subtraction piece in the Cottingham formula for the p-n mass difference
[RIFP-148] N72-27760
Ionization relaxation in shock heated argon
[CP-36] N72-27772
Determination of thermodynamic properties of shock produced argon plasma
[CP-33] N72-27773
Ionization relaxation study of shock heated argon with microwave reflection probe technique
[CP-32] N72-27774
Study of precursor phenomena ahead of ionizing shock waves
[CP-31] N72-27775

L

LABORATOIRE CENTRAL DE RECHERCHES THOMSON, ORSAY [FRANCE].
THX546: Supervidicon integrator for the ultraviolet
N72-27445
LABORATOIRE DE RECHERCHES BALISTIQUES ET AERODYNAMIQUES, VERNON [FRANCE].
Report on tests on the Bertin fluidic gyroscope carried out at the CEV/LEA
[LRBA-E204-PV-5] N72-27471
LABORATOIRES D'ELECTRONIQUE ET DE PHYSIQUE APPLIQUEE, LIMEIL-BREVANNES [FRANCE].
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N72-27437
Thermopiles for horizon sensors
N72-27439
The beads of electron multiplier tubes [microchannel plates]. Application to image tubes
N72-27442
HR 300: A high speed, compact, and robust, microchannel plate
N72-27443
Transhorizon scanners
N72-27460
Static horizon scanner
N72-27461
Ground simulators for testing infrared horizon scanners
N72-27462
LABORATORIUM FUR BETRIEBSFESTIGKEIT, DARMSTADT [WEST GERMANY].
Statistical analysis of mission profile parameters of transport aircraft
[TB-88] N72-27035
Cumulative frequency distributions of pressure variations in mineral oil pipelines
[FB-93] N72-27325
LAVAL UNIV. [QUEBEC].
The approximation of Navier-Stokes equations for viscous incompressible fluids
N72-27297
Numerical solution of steady state Navier-Stokes equations
N72-27298
LEHIGH UNIV., BETHLEHEM, PA.
The fatigue strength of fillet welded connections
[AD-739341] N72-27540
LINCOLN LAB., MASS. INST. OF TECH., LEXINGTON.
Electromagnetic scattering from turbulent boundary layers
[AD-738632] N72-27193
Advanced electronic technology
[AD-739548] N72-27258
LITTLE [ARTHUR D.], INC., CAMBRIDGE, MASS.
Illustrative applications of air traffic control system capacity study methodology
[AD-738892] N72-27710
LITTON INDUSTRIES, BEVERLY HILLS, CALIF.
Apparatus for sampling particulates in gasses
[NASA-CASE-HQN-10037-1] N72-27424
LOCKHEED ELECTRONICS CO., HOUSTON, TEX.
Method and apparatus for decoding compatible convolutional codes
[NASA-CASE-MSC-14070-1] N72-27178
Data storage, image tube type
[NASA-CASE-MSC-14053-1] N72-27215
Ultrastable calibrated light source
[NASA-CASE-MSC-12293-1] N72-27411
LOCKHEED MISSILES AND SPACE CO., PALO ALTO, CALIF.
Signal reception on the Kosmos-381 from the magnetically conjugate domain
N72-27180
Unsteady viscous fluid motion in elastic cylindrical shell
N72-27309
Investigation of the motion of artificial ionized clouds in the upper ionosphere
N72-27377
Heat influx to an electron gas at h 180 km altitudes
N72-27378
Investigation of the influence of regular horizontal gradients and local and integrated electron concentrations in the ionosphere on the magnitude and character

of the change in the reduced difference in the Doppler frequency shift along an artificial earth satellite orbit
N72-27379
Electron optical devices for solar orientation and navigation
N72-27433
Second harmonic generation of a neodymium laser by crystalline powders of organic compounds
N72-27551
High frequency, single frequency laser and modulator study
[AD-738489] N72-27552
On the question of solar-cycle variations in excess radiation intensity at low altitudes
N72-27839

LOCKHEED MISSILES AND SPACE CO., SUNNYVALE, CALIF.
Multiple beam antenna system
[NASA-CR-112102] N72-27173
Impact of low cost refurbishable and standard spacecraft upon future NASA space programs. Payload effects follow-on study
[NASA-CR-127117] N72-27913
Impact of low cost refurbishable and standard spacecraft upon future NASA space programs. Payload effects follow-on study, appendix
[NASA-CR-127118] N72-27914

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[NASA-CR-122432] N72-27701

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[NASA-CR-127526] N72-27846
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[NASA-CR-112077-1] N72-27876
A study of system requirements for Phobos/Deimos missions. Volume 2: Phase 1 results, satellite rendezvous and landing missions
[NASA-CR-112077-2] N72-27877
A study of system requirements for Phobos/Diemos missions. Volume 3: Phase 2 results, satellite sample return missions and satellite mobility concepts
[NASA-CR-112077-3] N72-27878
A study of system requirements for Phobos/Deimos missions. Volume 4: Phase 3 results, combined missions to Mars and its satellites
[NASA-CR-112077-4] N72-27879
Space shuttle propulsion systems on-board checkout and monitoring system development study [extension]. Volume 1: Summary and technical results
[NASA-CR-123712] N72-27911
Systems-level study of a nonsurvivable Jupiter turbopause probe. Volume 1: Summary
[NASA-CR-122436] N72-27933
Systems-level study of a nonsurvivable Jupiter turbopause probe. Volume 2: Supporting technical studies
[NASA-CR-122439] N72-27934

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General considerations in guidance and control technology
N72-27682
Laboratory techniques and evaluation methodology
N72-27688

MARYLAND UNIV., COLLEGE PARK.
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[NASA-CR-127263] N72-27206
Web automata
[TR-72-182] N72-27216
Observations of interchange between acceleration and thermalization processes in auroral electrons
[NASA-CR-127522] N72-27346
CO2 laser cold cathode study
[NASA-CR-122441] N72-27550
Solutions of the Bethe-Salpeter equation in the infinite-momentum limit
[TR-72-111] N72-27622
Bethe-Salpeter equation in the infinite momentum limit
[TR-72-101] N72-27623
Rigorous bounds on coupling constants in two dimensional field theories
[TR-73-003] N72-27764
Radial effects in the symmetric quark model
[TR-72-122] N72-27765
Radial excitations in the symmetric quark model
[TR-72-088] N72-27766
Monopole theory with potentials
[TR-72-129] N72-27767
A renormalizable model of weak and electromagnetic interactions with CP-violation
[TR-72-084] N72-27768

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[AD-739340] N72-27580

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[MPI-PAE-EXTRATERR-59] N72-27896

MAYO CLINIC, ROCHESTER, MINN.
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[NASA-CR-127262] N72-27078

MCDONNELL-DOUGLAS ASTRONAUTICS CO., HUNTINGTON BEACH, CALIF.
Adjoint solutions to intercept guidance
N72-27684
Optimization
N72-27685
Kalman filter
N72-27686
Space station executive summary
[NASA-CR-123719] N72-27912

MCDONNELL-DOUGLAS ASTRONAUTICS CO., SANTA MONICA, CALIF.
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[AD-739204] N72-27604

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[NASA-CR-112034-1] N72-27922

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Portable life support for instrumentation of an offshore platform
N72-27123
An emergency survival suit
N72-27132

MESSERSCHMITT-BOELKOW-BLOHM G.M.B.H., MUNICH [WEST GERMANY].
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N72-27020

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[AD-738633] N72-27782

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N72-27286

MICHIGAN UNIV., ANN ARBOR.
Application of research on cognition to man-machine system design
[AD-739708] N72-27201
Microwave solid-state device and circuit studies
[AD-739549] N72-27257
Remote sensing of changes in morphology and physiology of trees under stress
[NASA-CR-127420] N72-27375

MINNESOTA UNIV., MINNEAPOLIS.
Analysis of the opening dynamics of solid flat and ringslot parachutes with supporting wind tunnel experiments
[AD-739554] N72-27046
Experiments on the Josephson junction amplifier
[AD-739383] N72-27243
Proper motion survey with the 48-inch Schmidt telescope. 30: Proper motions for 1357 faint stars
[NASA-CR-127264] N72-27849

MITRE CORP., MCLEAN, VA.
The single-sided LIM with saturated back iron
[PB-207327] N72-27238

MONSANTO RESEARCH CORP., DAYTON, OHIO.
Trace analysis for metals in aerospace materials by gas chromatography
[AD-739865] N72-27166

N

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Transformation of scientists and engineers into managers
[NASA-SP-291] N72-27986

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Solar cells: Outlook for improved efficiency
[NASA-CR-127234] N72-27055
The panel's report
N72-27056
An introduction to the physics of solar cells
N72-27057
Theoretical efficiency considerations for photovoltaic energy converters
N72-27058
The fundamentals of improved silicon solar-cell performance
N72-27059
Photosynthesis
N72-27060

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. AMES RESEARCH CENTER, MOFFETT FIELD, CALIF.
Transonic transport study: Economics
[NASA-TM-X-62159] N72-27015
Simplified methods for interpreting the effect of transfer-function zeros on the transient response of aircraft
[NASA-TM-X-2585] N72-27024
Comparison of wind tunnel and flyover noise measurements of the YOV-10A STOL aircraft
[NASA-TM-X-62166] N72-27031
Second Conference on Portable Life Support Systems
[NASA-SP-302] N72-27106
A liquid cooled garment temperature controller based on sweat rate
N72-27125
Effect of neck warming and cooling on thermal comfort
N72-27126
Catalyzed sodium chlorate candles
N72-27131
Bio-isolated dc operational amplifier
[NASA-CASE-ARC-10596-1] N72-27233
Pitot-pressure distributions of the flow field of a delta-wing orbiter
[NASA-TM-X-62122] N72-27292
Convection in the tanks of a rotating spacecraft
[NASA-TR-R-386] N72-27313
Stereoscopic television system and apparatus
[NASA-CASE-ARC-10160-1] N72-27728
High speed shutter
[NASA-CASE-ARC-10516-1] N72-27739
Assessment of Jupiter's trapped radiation by pioneer
N72-27872

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. ELECTRONICS RESEARCH CENTER, CAMBRIDGE, MASS.
Method and apparatus for limiting field emission current
[NASA-CASE-ERC-10015-2] N72-27246

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. FLIGHT RESEARCH CENTER, EDWARDS, CALIF.
Statistical survey of XB-70 airplane responses and control usage with an illustration of the application to handling qualities criteria
[NASA-TN-D-6872] N72-27013
A flight-rated liquid-cooled garment for use within a full-pressure suit
N72-27121

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. GODDARD SPACE FLIGHT CENTER, GREENBELT, MD.
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[NASA-CASE-GSC-10344-1] N72-27053
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The 1971 NASA/Goddard-Aerospace Industry Battery Workshop, volume 2
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Application of an onboard processor to the OAO C spacecraft
[NASA-TM-X-65937] N72-27211
Environmental impact statement for the Goddard Space Flight Center
[NASA-TM-X-68549] N72-27263
Lunar roving vehicle magnetic tests
[NASA-TM-X-65927] N72-27274
World maps of predicted electron intensities for the ITOS-A/NOAA-1 spacecraft
[NASA-TM-X-65917] N72-27357
The diurnal heat budget of the thermosphere
[NASA-TM-X-65928] N72-27364
Polar cap electric field distributions related to the interplanetary magnetic field direction
[NASA-TM-X-65934] N72-27365

Functional characteristics of the OGO main body airglow photometer
[NASA-TM-X-65926] N72-27423
Double floating probe measurements on S-cubed A
[NASA-TM-X-65931] N72-27432
Power supply for CO2 lasers
[NASA-CASE-GSC-11222-1] N72-27548
Absolute frequency of an atomic hydrogen maser clock
[NASA-TM-X-65936] N72-27549
Magnetic dipole moment determination by near-field analysis
[NASA-TN-D-6685] N72-27732
Response of a shroud-enclosed spacecraft to combined acoustic-vacuum environments
[NASA-TM-X-65922] N72-27734
Acoustic response comparison for a spacecraft tested with and without a shroud
[NASA-TM-X-65921] N72-27735
Hydrogen as an atomic beam standard
[NASA-TM-X-65932] N72-27763
Measurements of the Fe-group abundance in energetic solar particles
[NASA-TM-X-65919] N72-27833
Previous design restraints and radiation damage effects of low energy particles
N72-27856
The effect of Jupiter's satellites on the diffusion of protons
N72-27864
A resonant instability of model proton radiation belts in the Jovian magnetosphere
N72-27870
Apollo 16 geochemical X-ray fluorescence experiment: Preliminary report
[NASA-TM-X-65918] N72-27880
ATS simultaneous and turnaround ranging experiments
[NASA-TM-X-65920] N72-27885
Origin of the moon: New data from old rocks
[NASA-TM-X-65924] N72-27886
Role of gas surface interactions in the reduction of OGO-6 neutral gas particle mass spectrometer data
[NASA-TM-X-65923] N72-27887
Further analysis of the Venus atmosphere measurements
[NASA-TM-X-65929] N72-27888
Detection of interplanetary electrons from 18 keV to 1.8 MeV during solar quiet times, 1. On the origin of 200 KeV interplanetary electrons, 2.
[NASA-TM-X-65935] N72-27889
IMP F and G phase 1 magnetic field analysis
[NASA-TM-X-63086] N72-27894

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. JOHN F. KENNEDY SPACE CENTER, COCOA BEACH, FLA.

An altitude chamber rescue ensemble
N72-27133
Pressurized lighting system
[NASA-CASE-KSC-10644] N72-27227
Lightning tracking system
[NASA-CASE-KSC-10729-1] N72-27234
AS-511 facilities and environmental measurements program
[NASA-TM-X-68517] N72-27261
Space shuttle horizontal flight test plan
[NASA-TM-X-68515] N72-27915
Apollo/Saturn C00.00.19.3 operations and maintenance. Cathodic protection of communication cables
[KSC-TM4-275-MI] N72-27916
Apollo/Saturn 5 space vehicle countdown. Volume 2: Turnaround from scrub
[NASA-TM-X-68516] N72-27917
Skylab consolidated instrumentation plan for SL-1/SL-2
[NASA-TM-X-68520] N72-27918

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LANGLEY RESEARCH CENTER, LANGLEY STATION, VA.

Jet effects on the drag of conical afterbodies at supersonic speeds
[NASA-TN-D-6789] N72-26997
Terminal-area flight procedures and route design for supersonic transport New York-transatlantic operations
[NASA-TN-D-6801] N72-27010
Summary of design considerations for airplane spin-recovery parachute systems
[NASA-TN-D-6866] N72-27033
Liquid waste feed system
[NASA-CASE-LAR-10365-1] N72-27102
Means for adjusting input signal bias
[NASA-CASE-LAR-10868-1] N72-27232
Technique for extending the frequency range of digital dividers
[NASA-CASE-LAR-10730-1] N72-27255
Apparatus for applying simulated G-forces to an arm of an aircraft simulator pilot
[NASA-CASE-LAR-10550-1] N72-27271
Wind tunnel model and method
[NASA-CASE-LAR-10812-1] N72-27272
Numerical solutions of the Navier-Stokes equations for the supersonic laminar flow over a two-dimensional compression corner
[NASA-TR-R-385] N72-27311
Discrete sonic jets used as boundary-layer trips at Mach numbers of 6 and 8.5
[NASA-TN-D-6802] N72-27312
Microcircuit negative cutter
[NASA-CASE-XLA-09843] N72-27485
Apparatus and method for applying protective coatings
[NASA-CASE-LAR-10362-1] N72-27486
Method of repairing discontinuity in fiber glass structures
[NASA-CASE-LAR-10416-1] N72-27527
Apparatus for aiding a pilot in avoiding a midair collision between aircraft
[NASA-CASE-LAR-10717-1] N72-27703
Light regulator
[NASA-CASE-LAR-10836-1] N72-27784
Variably positioned guide vanes for aerodynamic choking
[NASA-CASE-LAR-10642-1] N72-27820
Anti-buckling fatigue test assembly
[NASA-CASE-LAR-10426-1] N72-27947
Linear explosive comparison
[NASA-CASE-LAR-10800-1] N72-27959

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LEWIS RESEARCH CENTER, CLEVELAND, OHIO.

An efficient algorithm using matrix methods to solve wind tunnel force-balance equations
[NASA-TN-D-6860] N72-27002
Noise generated by STOL core-jet thrust reversers
[NASA-TM-X-68082] N72-27012
Experimental evaluation of a TF30-P-3 turbofan engine in an altitude facility: Afterburner performance and engine-afterburner operating limits
[NASA-TN-D-6839] N72-27014
Forward flight effects on mixer nozzle design and noise considerations for STOL externally blown flap systems
[NASA-TM-X-68102] N72-27029
Preliminary noise tests of the engine-over-the-wing concept. 2: 10 deg - 20 deg flap position
[NASA-TM-X-68104] N72-27030
Adhesion and transfer of PTFE to metals studied by auger emission spectroscopy
[NASA-TM-X-68076] N72-27150
Variance reduction in Monte Carlo analysis of rarefied gas diffusion
[NASA-TM-X-68094] N72-27156
The 200 watt SHF transmitter experiment package
[NASA-TM-X-68106] N72-27177
Inductance device with vacuum insulation
[NASA-CASE-LEW-10330-1] N72-27226
Environmental impact statement for National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
[NASA-TM-X-68557] N72-27266
Effect of contact angle hysteresis on moving liquid film integrity
[NASA-TM-X-68071] N72-27291
Apparatus for sensing temperature
[NASA-CASE-XLE-05230] N72-27410
A spiral groove seal
[NASA-CASE-XLE-10326-4] N72-27522
Optimal speed sharing characteristics of a series-hybrid bearing
[NASA-TM-X-68093] N72-27528
Summary of gas bearing applications in the field of space electric power systems
[NASA-TM-X-68095] N72-27529
A new criterion for predicting rolling-element fatigue lives of through-hardened steels
[NASA-TM-X-68078] N72-27573
Hydrogen environment embrittlement
[NASA-TM-X-68088] N72-27574
Quasi-three-dimensional calculation of velocities in turbomachine blade rows
[NASA-TM-X-67959] N72-27720
A 1055 ft/sec impact test of a two foot diameter model nuclear reactor containment system without fracture
[NASA-TM-X-68103] N72-27721
Performances of the better metallic electrodes in cesium thermionic converters
[NASA-TM-X-68091] N72-27722
Gas-core reactor power transient analysis
[NASA-TM-X-68089] N72-27723
Some contributions to energetics by the Lewis Research Center and a review of their potential non-aerospace applications
[NASA-TM-X-68092] N72-27737
Experience with low cost jet engines
[NASA-TM-X-68085] N72-27816
Predicted upwash angles at engine inlets for STOL aircraft
[NASA-TM-X-2593] N72-27817
Optimization of electrostatic dual-grid beam-deflection system
[NASA-TM-X-68096] N72-27824
Five-centimeter diameter ion thruster development
[NASA-TM-X-68110] N72-27825
Joule-Thomson inversion curves and related coefficients for several simple fluids
[NASA-TN-D-6807] N72-27965
An analytical and experimental evaluation of shadow shields and their support members
[NASA-TM-X-68099] N72-27966

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Powerplexer
[NASA-CASE-MSC-12396-1] N72-27063
Apollo portable life support system performance report
N72-27110
Skylab astronaut life support assembly
N72-27117
Interpolation constants for calculation of transmittance and rate of dissociation of molecular oxygen in the mesosphere and lower thermosphere
[NASA-TM-X-58084] N72-27349

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Spherical balloon response to three-dimensional time-dependent flows
[NASA-TN-D-6829] N72-27001
Altitude simulation chamber for rocket engine testing
[NASA-CASE-MFS-20620] N72-27262
Environmental impact statement for NASA's Marshall Space Flight Center
[NASA-TM-X-68542] N72-27264
Design of a Mach 8.0 axisymmetric nozzle for a hypersonic test facility
[NASA-TM-X-64664] N72-27273
Fixture for supporting articles during vibration tests
[NASA-CASE-MFS-20523] N72-27412
Ultrasonic scanner for radial and flat panels
[NASA-CASE-MFS-20335-1] N72-27421
Research achievements review, volume 4. Quality and reliability assurance research at MSFC
[NASA-TM-X-64666] N72-27516
Advanced radiographic imaging techniques
N72-27517
Advanced materials inspection techniques
N72-27518
Gaseous flow detection techniques for in-space application
N72-27519
Quality and reliability requirements for hybrid microcircuits
N72-27520
Bond problems caused by thermal excursion
N72-27521
Cryogenic gyroscope housing
[NASA-CASE-MFS-21136-1] N72-27731
A description of the thruster attitude control simulation and its application to the HEAO-C study
[NASA-TM-X-64660] N72-27815
Variational differential equations for engineering type trajectories close to a planet with an atmosphere
[NASA-TM-X-64679] N72-27891

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Environmental impact statement concerning activities of the National Aeronautics and Space Administration at Wallops Island, Virginia
[NASA-TM-X-68547] N72-27265

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Environmental statement for Earth Resources Aircraft program
[NASA-TM-X-68550] N72-27008
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[NASA-SP-7011[102]] N72-27076
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Intasat satellite project: Specification of the codification unit design
[NASA-TT-F-13899] N72-27171
Environmental statement, reactor testing, FY 1972 Nuclear Rocket Development Station Nevada
[NASA-TM-X-68555] N72-27268
Investigation of electron spectra in the earth's inner radiation belt by the satellite Kosmos 219
[NASA-TT-F-14405] N72-27355
Environmental statement for the global atmospheric research program
[NASA-TM-X-68546] N72-27632
A study of Feynman diagrams of the first two orders for some states of light atoms. 3: Numerical calculations of contributions and diagrams
[NASA-TT-F-14402] N72-27753
Ion discrimination in mass spectrometers
[NASA-TT-F-14326] N72-27759
Environmental impact statement quiet engine program
[NASA-TM-X-68545] N72-27814
Environmental statement for National Aeronautics and Space Administration Office of Manned Space Flight Apollo program
[NASA-TM-X-68544] N72-27903
Environmental statement for Pioneer F/G program
[NASA-TM-X-68543] N72-27904

Environmental statement for National Aeronautics and Space Administration Skylab program
[NASA-TM-X-68553] N72-27905
Environmental statement for Earth Resources Technology Satellite program
[NASA-TM-X-68552] N72-27906
Environmental statement for TIROS program
[NASA-TM-X-68551] N72-27907
Environmental statement for Nimbus program
[NASA-TM-X-68554] N72-27908
Environmental statement for physics and astronomy sounding rocket, balloon, and airborne research programs
[NASA-TM-X-68556] N72-27909
Environmental statement for the space shuttle program
[NASA-TM-X-68541] N72-27910
Intelsat 4: Press kit
[NASA-TM-X-68518] N72-27921
Report of the NASA Ad Hoc Committee on failure of high strength structural materials
[NASA-TM-X-68850] N72-27946
Background material on the agreement signed 24 May in Moscow on cooperation in space between the United States and the Soviet Union News release N72-27972

NATIONAL AEROSPACE LAB., AMSTERDAM [NETHERLANDS].
Experimental determination of nozzle characteristics and nozzle airframe interference N72-27021
Crack propagation in a full-scale wing structure under random flight-simulation loading
[NLR-TR-71043-U] N72-27955
Thermal conductivity of honeycomb sandwich panels for space applications
[NLR-TR-71031-U] N72-27967

NATIONAL AEROSPACE LAB., TOKYO [JAPAN].
Some considerations on the aerodynamic characteristics for the body of a rocket with blunt nose
[NAL-TR-266] N72-26998
Aerodynamic design and test results of front fans
[NAL-TR-268T] N72-26999
Interference between wing and surface of velocity discontinuity
[NAL-TR-254] N72-27000
An analytical method to predict height-velocity diagram and critical decision point of rotorcraft
[NAL-TR-245] N72-27026
Overall ground experiments on flying test bed for VTOL aircraft at National Aerospace Laboratory
[NAL-TR-276] N72-27027
On the aerodynamic damping moment in pitch of a rigid helicopter rotor in hovering
[NAL-TR-256] N72-27028
Development of turbulent boundary layers along the curved walls of an annular diffusing passage
[NAL-TR-278T] N72-27316
A description of the ideas underlying a computer program for predicting the aerofoil pressure distributions in subcritical viscous flow
[NAL-TR-248] N72-27317
A study of subsonic, two-dimensional wall-interference effect in a perforated wind tunnel with particular reference to the NAL 2 m by 2 m transonic wind tunnel: Inapplicability of the conventional boundary condition
[NAL-TR-252T] N72-27318
A high sensitive atmospheric temperature measuring apparatus
[NLA-TR-260] N72-27427
Fluidic turbine inlet gas temperature sensor
[NAL-TR-265] N72-27428
Study of a rotary drive vibratory output rate gyro
[NAL-TR-259] N72-27429
Approximation of linear operator semigroups
[NAL-TR-269T] N72-27619
An investigation of a high speed axial-flow turbine. 2: A single stage turbine
[NAL-TR-273] N72-27822
An investigation of a transonic axial-flow turbine. 1: A cold air test of the annular turbine nozzle cascade
[NAL-TR-272] N72-27823
Inertial force field due to nutational motion of a spinning axisymmetric satellite and its application to nutation dampers
[NAL-TR-251] N72-27892
Three dimensional sub-optimal explicit guidance for space vehicles
[NAL-TR-258] N72-27931
Flight control system design for launch vehicles with liquid propellant
[NAL-TR-264] N72-27932
Investigation of the strength of axial-flow compressor disc. 1: On the disc with many pin holes
[NAL-TR-274] N72-27948
On the vibration of three-parallel-beams
[NAL-TR-271] N72-27949
Stress and strain concentration factors of strips with a central circular hole in linear strain-hardening materials
[NAL-TR-279] N72-27950
A structural analysis of cylinder-cone-cylinder shells by the finite element method
[NAL-TR-262] N72-27952
Dynamic stability of a connected rod under periodic longitudinal force
[NAL-TR-257] N72-27953

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Intensity control of flashers
[FAA-RD-72-54] N72-27700
Simulation study of diamond runway marks for aircraft approach guidance
[FAA-NA-72-57] N72-27702

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[NBS-SP-300-VOL-5] N72-27523
Cryogenic research and development
[NASA-CR-127275] N72-27730

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A simple correction procedure for quantitative electron probe microanalysis
[NBS-TN-719] N72-27209
A computer terminal network for transparent stimulation of the user of an on-line retrieval system
[NBS-TN-732] N72-27217
Precision measurement and calibration: Colorimetry
[NBS-SP-300-VOL-9] N72-27524
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NCAR research and facilities programs
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[NLL-M-22437-[5828.4F]] N72-27009
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Reaction mechanism of Na[plus]-K[plus] dependent ATP-ase
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Electrolytic separation and cyclic voltametry of reduction of manganese dioxide
[NLL-M-22291-[5828.4F]] N72-27141
Concerning thermal transformations of carbo- and hetero-chain polymers
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Hydrogenation of metals during interaction with water
[NLL-M-21374-[5828.4F]] N72-27145
The effect of certain vapours and liquids on the friction properties of molybdenum disulphide
[NLL-RISLEY-TR-2363-[9091.9F]] N72-27146
Galvanic corrosion of metals
[NLL-TRANS-746-1174-[9022.401]] N72-27147
Blocking the spontaneous polarisation in glycol sulphate
[NLL-TRANS-855-[9022.64]] N72-27148
The dimensioning of anti-corona electrodes for a high voltage research laboratory
[NLL-CE-TRANS-5794-[9022.09]] N72-27247
New general configuration and new synthesis procedure for all pass networks of the RC type
[NLL-TRANS-2850-[9022.81]] N72-27248
Ways of creating an automatic system for collecting, storing, retrieving and processing hydrochemical information for stations of the USSR hydrometeorological service
[NLL-M-22307-[5828.4F]] N72-27270
Fluid mechanics: A new description of the coefficient of viscosity or of turbulent diffusion
[NLL-T-1507-[9022.305]] N72-27289
The significance of atmospheric electricity in meteorology
[NLL-M-22318-[5828.4F]] N72-27336
Some characteristics of wind waves in the deep and shallow waters of a bay
[NLL-TRANS-2508-[3623.66]] N72-27337
On the structure of the sea surface temperature field
[NLL-M-22342-[5828.4F]] N72-27338
Preparation of hydrological observations for past years for use on computers
[NLL-M-22333-[5828.4F]] N72-27340
Automation of the working up of hydrological observations
[NLL-M-22344-[5828.4F]] N72-27341
Automatic processing of operational hydrological information
[NLL-M-22339-[5828.4F]] N72-27342
Methods for the automatic control and processing of the results of gauge observations
[NLL-M-22341-[5828.4F]] N72-27343
Studies on the water and heat balance of slopes
[NLL-M-22458-[5828.4F]] N72-27344
The construction and operation of a countercurrent continuous gas chromatograph
[NLL-RTS-6992] N72-27407
Measurements in turbulent flow: Hot wire anemometry
[NLL-TRANS-T-1521-[9022.305]] N72-27413
Infrared analysers and other industrial photometers
[NLL-SMRE-TRANS-5691-[8313.4]] N72-27414
Use of data acquisition system in calorimetry
[NLL-LIB-COMM-1656-[5196]] N72-27416
A calorimeter as a standard device to measure energy doses and the determination of mean energy output to generate an ion pair in air
[NLL-M-22434-[5828.4F]] N72-27417
Sensitivity changes in neutron detectors in variable gamma fields
[NLL-WH-TRANS-324-[9091.9F]] N72-27418
Determination of limiting drawing ratio using drawing force and tear strength: Application to stainless steel sheet
[NLL-TRANS-746-1152-[9022.401]] N72-27483
Safety in the running of plant producing and using oxygen
[NLL-CE-TRANS-5849-[9022.09]] N72-27487
New method of rapid electrolytic surface polishing and its metallographic applications
[NLL-T-1514-[9022.305]] N72-27488
The theory of rotary extrusion of shells of revolution
[NLL-M-21379-[5828.4F]] N72-27489
Cementation in electrically conductive fluidized bed
[NLL-TRANS-746-1149-[9022.401]] N72-27490
Capacitive method for measuring the thickness of the metallic coating on one side of plastic sheeting
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Some regularizations in processes of abrasive wear of the carbides of the transition metals
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Weldability of cast irons: The use of continuous cooling transformation diagrams
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Polycrystalline metal whiskers for composites
[NLL-TRANS-746-1106-[9022.401]] N72-27555
Two-stage surface-hardening
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Determination of the work-hardening exponent from the load-strain-curve
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Development of the flotation of particles of limiting size
[NLL-RTS-6963] N72-27558
Selection of intermediate layers for corrosion resistant bimetals
[NLL-TRANS-746-1147-[9022.401]] N72-27559
Creep rupture strength and electron microstructures of 2 1/4 percent Cr-1 percent Mo steels after heat treatments
[NLL-CE-TRANS-5594-[9022.09]] N72-27560
Activity and solubility of carbon in austenitic chromium-nickel steels with approximately 18% Cr
[NLL-CE-TRANS-5881-[9022.09]] N72-27561
Dynamic strain-aging of S.G. iron
[NLL-TRANS-746-1167-[9022.401]] N72-27562
Enlargement of dispersed inclusions of oxides in Nichrome during annealing
[NLL-TRANS-746-1173-[9022.401]] N72-27563
Plasticity of metals under high pressure, part 2
[NLL-NEL-TT-2371-[6075.461]]

N72-27564
Mechanical properties and cold shortness of low-alloy steel containing cerium
[NLL-T-518-[9022.305]] N72-27565
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[NLL-TRANS-746-1155-[9022.401]]
N72-27566
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[NLL-TRANS-746-1143-[9022.401]]
N72-27567
Superplasticity of nickel-chromium eutectic alloy
[NLL-TRANS-746-1185-[9022.401]]
N72-27568
Structural diagram of deformed stainless steels
[NLL-TRANS-746-1176-[9022.401]]
N72-27569
The degasification of silumin alloy melts by means of treatment with lumpy titanium
[NLL-294-[8660.5]] N72-27570
Flow stress and strain rate during extrusion
[NLL-LTI-746-1181-[9022.401]]
N72-27571
Obtaining the nickel-tin alloy with the help of hydrazine hydrate
[NLL-TRANS-746-1196-[9022.401]]
N72-27572
Silicon, silicon nitride
[NLL-RTS-7103] N72-27594
Investigations into the chemical hardening of glazes
[NLL-T-1509-[9022.305]] N72-27595
Heat resistant composite material: Nichrome W fibre
[NLL-TRANS-746-1148-[9022.401]]
N72-27596
Nichrome: Molybdenum, tungsten composite materials
[NLL-TRAS-746-1190-[9022.401]]
N72-27597
Electric conduction in glass
[NLL-TRANS-852-[9022.64]] N72-27598
Prospects for the development of fibre reinforced high temperature materials
[NLL-TRANS-746-1195-[9022.401]]
N72-27599
Particular solutions of the Laplace tidal equation
[NLL-M-22323-[5828.4F]] N72-27612
On estimates of the best approximation of many-variable functions by the sums of two functions of lesser numbers of variables
[NLL-M-22320-[5828.4F]] N72-27613
Aspects of the use of orthonormal exponential functions in hydrometeorology
[NLL-M-22459-[5828.4F]] N72-27614
Method of obtaining fields of partial derivatives by the method of Moire bands
[NLL-M-21376-[5828.4F]] N72-27615
Relation between radiation inversions at night and the diurnal range of air temperature
[NLL-M-22336-[5828.4F]] N72-27630
Ways of realising a system for the automation of the collection, analysis, processing and dissemination of operational agrometeorological information
[NLL-M-22337-[5828.4F]] N72-27631
Some remarks on the use of scale analysis in dynamic meteorology
[NLL-M-22384-[5828.4F]] N72-27634
Relation between the date of the transition from summer to early autumn in the Fukuoka area and the temperatures of the Kyushu district in the following winter
[NLL-M-22196-[5828.4F]] N72-27637
Meteorological assistance for the Concorde trial flights
[NLL-M-22439-[5828.4F]] N72-27638
An example of a cold front moving south in the Japan Sea in autumn
[NLL-M-22454-[5828.4F]] N72-27639
On the determination of routes with minimum flight time at SST flight altitudes
[NLL-M-22436-[5828.4F]] N72-27672
Thermal models of nuclear fuel elements
[NLL-CE-TRANS-5885-[9022.09]]
N72-27715
A series of experiments to study the behaviour of metallic insulations in helium
[NLL-WH-TRANS-321-[9091.9F]]
N72-27716
On the theory of hysteresis losses in a rotating magnetic field
[NLL-CE-TRANS-5686-[9022.09]]
N72-27729
Micro-weighing, an important source of error in the metrology of radioactivity
[NLL-M-22443-[5828.4F]] N72-27749
Study of the effect of the magnetic state and of the thicknesses of thin nickel films on magnetoelastic properties: Test results
[NLL-LTI-746-1160-[9022.401]]
N72-27785
Study of the effect of the magnetic state of thin films of nickel on magnetoelastic properties
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N72-27786
Representation of un-conservatively moved dislocations by linear sources of vacancies
[NLL-M-21377-[5828.4F]] N72-27787
Temperature function of the speed of sound and the structure of metallic liquids
[NLL-M-21371-[5828.4F]] N72-27788
The significance of resistivity changes caused by adsorption of gases on thin metallic films
[NLL-TRANS-746-1194-[9022.401]]
N72-27789
Solar constant and climate of the earth
[NLL-M-22455-[5828.4F]] N72-27830
The 1,000-hour stress-rupture strength at 300-700 C and the oxidation mechanism of brazed joints in heat-resistant alloys
[NLL-LTI-746-1165-[9022.401]]
N72-27941
Stress-relaxation tests on S. G. iron GGG-38/42
[NLL-TRANS-746-1168-[9022.401]]
N72-27942
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N72-27943
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[NLL-M-22432-[5828.4F]] N72-27944
Some characteristics of laminar diffusion flames
[NLL-T-1530-[9022.305]] N72-27960
The detonation properties of some heterogeneous systems
[NLL-298-[8660.5]] N72-27961
Empirical equations for the relationship of the thermal and physical properties of steel to temperature
[NLL-M-21368-[5828.4F]] N72-27962
Green functions in the solution of thermal conductivity problems for a hollow cylinder
[NLL-WH-TRANS-325-[9091.9F]]
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[AD-739326] N72-27278

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[AD-739331] N72-27036
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[AD-739699] N72-27098
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NAVAL AIR SYSTEMS COMMAND, WASHINGTON, D.C.

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[AD-739689] N72-27714

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Engine integration and thrust/drag definition
N72-27023
Amplitude modulation of an acoustic wave propagating near the sea surface
[AD-739357] N72-27388
Regression methods in five day mean height prediction at 500 mb using mean nimbus 2 composited infrared data for identical periods in the update procedure
[AD-739358] N72-27656
Studies pertaining to solid propellant fracture
[AD-739355] N72-27812

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Observation of X-ray lines from highly ionized iron in a laser plasma
[AD-739255] N72-27160
Irradiation effects on reactor structural materials
[AD-739312] N72-27726

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The position of eardrum rupture and hearing loss in the scale of injuries from nuclear blast
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N72-27108

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Navy-developed life support systems for fully enclosed protective suits
N72-27111
Hydrospace simulator facility for materials testing
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[AD-737700] N72-27088
Operation and testing of Mark 10 Mod 3 underwater breathing apparatus
N72-27119
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N72-27120

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N72-27017
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N72-27852

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N72-27452

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N72-27301

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N72-27302

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N72-27303

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N72-27304

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N72-27007

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N72-27845

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[P-4791] N72-27214

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Internal plasticisation of aromatic polyesters by alkyl side chains
[RAE-TR-71223] N72-27158

Arylene perfluoro alkylene modified polysiloxanes
[RAE-TR-71224] N72-27159

Numerical analysis and simulation evolution
N72-27687

Methodology of research into command-line-of-sight and homing guidance
N72-27692

Density variations in the exosphere from June 1968 to December 1970
[RAE-TR-71150] N72-27897

Table of space vehicles launched during the years 1958 - 1971
[RAE-TR-72004] N72-27898

Equations for 15th order geopotential coefficients from the orbit of transit 1B
[RAE-TR-72003] N72-27899

Measurements of upper-atmosphere rotational speed from changes in satellite orbits
[RAE-TR-71171] N72-27900

ROYAL INST. OF TECH., STOCKHOLM [SWEDEN].
Magnetosphere-ionosphere coupling
[TRITA-EPP-72-11] N72-27385

On the numerical determination of optimal control strategies for air quality standards and regulatory policy
[PB-207975] N72-27671

Electrostatic singularity in a plasma in a magnetic mirror field
[TRITA-EPP-72-10] N72-27777

On the formation of double layers in plasmas
[TRITA-EPP-72-09] N72-27778

Collisional broadening of Landau levels in a polar semiconductor
N72-27795

Low field transport properties of a polar semiconductor in a quantizing magnetic field
N72-27796

Transport properties of a polar semiconductor in a quantizing magnetic field
N72-27797

ROYAL OBSERVATORY, EDINBURGH [SCOTLAND].
Stopwatch observations of satellites, February 1972
[ROE-STS-123] N72-27936

Stopwatch observations of satellites, March 1972
[ROE-STS-124] N72-27937

S

SAAB AIRCRAFT CO., LINKOPING [SWEDEN].
A photogrammetric three-point method for analysing the motion of moving objects
[SAAB-TN-68] N72-27472

SAFETY IN MINES RESEARCH ESTABLISHMENT, SHEFFIELD /ENGLAND/.
Tolerance to external breathing resistance with particular reference to high inspiratory resistance
N72-27127

Influence of facemask design on operational performance
N72-27130

SCHOOL OF AEROSPACE MEDICINE, BROOKS AFB, TEX.
Bioacoustic noise problems during operation of C-7A Caribou aircraft
[AD-738627] N72-27086

Hazard study of six helium-neon laser boresights
[AD-738629] N72-27087

An automated, six-channel, discrete-sample electrolyte analyzer
[AD-737568] N72-27091

Development of binaural time-delay apparatus for improving intelligibility of speech
[AD-738628] N72-27192

SCIENTIFIC GROUP FOR SPACE RESEARCH, ATHENS [GREECE].
Data of solar terrestrial interest, August 1971
N72-27836

Data of solar terrestrial interest, July 1971
N72-27837

SCIENTIFIC MANAGEMENT SYSTEMS, INC., BETHESDA, MD.
Design study of a low bit rate transmitter and simulator
[NASA-CR-122435] N72-27168

SCIENTIFIC TRANSLATION SERVICE, SANTA BARBARA, CALIF.
Space biology
[NASA-TT-F-14307] N72-27081

On the nature of the hydrogen adsorption at platinum metal electrodes
[NASA-TT-F-14361] N72-27152

Relationship between outgoing microwave radiation and the surface of the sea [based on data obtained from the Kosmos-243 satellite
[NASA-TT-F-14400] N72-27170

A simple method for all purpose coding of a source of independent messages
[NASA-TT-F-13895] N72-27172

The 10 A switching transistor
[NASA-TT-F-14338] N72-27229

A differential method for solving the boundary layer equation for steady laminar incompressible flow
[NASA-TT-F-14363] N72-27314

Humidity measurement by means of infrared reflection
[NASA-TT-F-14333] N72-27640

Targets for neutron generators
[NASA-TT-F-14337] N72-27719
On ionization-recombination oscillations
[NASA-TT-F-14339] N72-27750
Collective oscillations of spherically symmetric rotating mass systems
[NASA-TT-F-14413] N72-27751
Investigation of Feynman diagrams of the first and second orders for some states of light atoms. 1: Expressions for contributions from the first- and second-order diagrams in terms of radial integrals
[NASA-TT-F-14403] N72-27752
Collective interactions of heavy nuclei nucleons and high-energy cosmic rays
[NASA-TT-F-14409] N72-27832

SCRIPPS INSTITUTION OF OCEANOGRAPHY, SAN DIEGO, CALIF.
Ocean surface, bottom, and near shore engineering
[AD-738476] N72-27404

SCRIPTA TECHNICA, INC., WASHINGTON, D.C.
Coding an information source that is continuous in amplitude but discrete in time
[NASA-TT-F-13896] N72-27207
Some properties of Hadamard matrices of order N equals 2 to the mth and the reduction of signal redundancy by use of digital filters
[NASA-TT-F-13897] N72-27616

SKF INDUSTRIES, INC., KING OF PRUSSIA, PA.
Exploratory analysis of elastohydrodynamic properties of lubricants
[AD-739390] N72-27546

SMITHSONIAN ASTROPHYSICAL OBSERVATORY, CAMBRIDGE, MASS.
Empirical data and the variance-covariance matrix for the 1969 Smithsonian Standard Earth [2]
[NASA-CR-127269] N72-27361
The significance of the redshift rocket probe experiment to the theories of gravitation
[NASA-CR-127429] N72-27363

SOCIETE ANONYME D'ETUDES ET REALISATIONS NUCLEAIRES, LIMEIL-BREUANNES (FRANCE).
The D2B satellite solar sensors
N72-27458

SOCIETE ANONYME DE TELECOMMUNICATIONS, PARIS (FRANCE).
Cd[x]Hg[1-x]Tee detector for space
N72-27440

SOCIETE D'ETUDES ET D'APPLICATION DE VIDE OPTIQUE ET MECANIQUE, FRANCONVILLE (FRANCE).
Report on results obtained in research on filters and mirrors for the far ultraviolet range
N72-27446
Design and development of infrared filters
N72-27447

SOCIETE GRENOBLOISE D'ETUDE ET D'APPLICATIONS HYDRAULIQUES (FRANCE).
PETULA (Program for Turbulent or Laminar Flows): An example of a complex mathematical model in fluid mechanics
N72-27308

SOUTH DAKOTA STATE UNIV., BROOKINGS.
Remote sensing for evaluating flood damage conditions. The Rapid City, South Dakota flood, 9 June 1972, field investigation report
[SDSU-RSI-72-11] N72-27368

SPERRY RAND CORP., GAINESVILLE, FLA.
Mass spectrometer tube construction
[NASA-CR-122433] N72-27231

SPERRY RAND RESEARCH CENTER, SUDBURY, MASS.
Research on variable threshold transistor storage systems
[NASA-CR-127276] N72-27250

STANFORD RESEARCH INST., MENLO PARK, CALIF.
Triggered lightning and some unsuspected lightning hazards
N72-27101

STANFORD UNIV., CALIF.
Annual and solar-magnetic-cycle variations in the interplanetary magnetic field, 1926-1971
[NASA-CR-127422] N72-27370
Methods for obtaining laser action at wavelengths shorter then 3000 A
[AD-739377] N72-27553
Guidance and control of flight vehicles
[NASA-CR-127268] N72-27679
Why does the sun sometimes look like a magnetic monopole?
[NASA-CR-127423] N72-27834
Applications of the theory of optimal control of distributed-parameter systems to structural optimization
[NASA-CR-2044] N72-27945

SYRACUSE UNIV., N.Y.
Improved programs for analysis of radiation and scattering by configurations of arbitrarily bent thin wires
[AD-739203] N72-27190

SYSTEMS SCIENCE AND SOFTWARE, LA JOLLA, CALIF.
The effects of meso-scale and small-scale interactions on global climate
[AD-739541] N72-27669

SYSTEMS TECHNOLOGY, INC., HAWTHORNE, CALIF.
Experimental measurements of motion cue effects on STOL approach tasks
[NASA-CR-114458] N72-27032

T

TECHNION - ISRAEL INST. OF TECH., HAIFA.
Generalized characteristics method for elastic wave propagation problems
[NASA-CR-127122] N72-27176
Effect of transverse disturbances on heat transfer in a laminar axisymmetric boundary layer
[TAE-146] N72-27320
An elliptical crack subjected to an impulsive load applied to its boundary
[TAE-148] N72-27951

TECHNISCHE HOCHSCHULE DARMSTADT (WEST GERMANY).
Quantitative measurements of the emission from high density nanosecond spark channels
[AD-739253] N72-27741

TECHNISCHE HOGESCHOOL, DELFT (NETHERLANDS).
Mossbauer effect studies of superparamagnetic alpha-F-eOOH and alpha-Fe2O3
N72-27793

TECHNISCHE UNIV., BERLIN (WEST GERMANY).
The influence of a display on the human transfer function measured by means of an adaptive analog pilot
[REPT-64] N72-27034
A new digital position correcting element for automatisation of processes
[REPT-57] N72-27532
The quasi-visual flight: A new navigation concept
[REPT-62] N72-27708

TECHNOLOGY SERVICE CORP., SANTA MONICA, CALIF.
Structural languages and biomedical signal analysis using interactive graphics
[AD-739258] N72-27135

TECHTRAN CORP., GLEN BURNIE, MD.
Experiments on a program of world magnetic survey
[NASA-TT-F-14407] N72-27354
Properties of organic driving media for diffusion pumps in technical operation and a new form of an oil diffusion pump
[NASA-TT-F-14276] N72-27530
Study of conversions in the platinum-iron system
[NASA-TT-F-14320] N72-27576
Numerical calculation of Hartree-Fock diagrams of first and second orders for energy of basic states of light atoms in field formulation of perturbation
[NASA-TT-F-14401] N72-27754

TELEDYNE BROWN ENGINEERING, HUNTSVILLE, ALA.
Skylab experimental performance evaluation manual. Appendix O: Experiment T002 manual navigation sightings (MSFC)
[NASA-CR-61386-APP-O] N72-27680
Skylab experiment performance evaluation manual. Appendix R: Experiment T020 foot controlled maneuvering unit (MSFC)
[NASA-CR-61386-APP-R] N72-27920

TELEDYNE GEOTECHNICAL, ALEXANDRIA, VA.
Generalized linear filtering of seismic array data
[AD-739178] N72-27393
Analysis of short period seismic signals and noise recorded at LASA and TFO
[AD-739181] N72-27394
Evaluation of the large array long period network
[AD-739174] N72-27396
Detection threshold of the LASA/SAAC system
[AD-739173] N72-27397
Seismic array analysis center
[AD-739172] N72-27398

TELEDYNE ISOTOPES, WESTWOOD, N.J.
Propagation of long period acoustic gravity waves in the atmosphere
[AD-739260] N72-27387

TELEDYNE MEC, PALO ALTO, CALIF.
The 3kW SATCOM transmitter traveling-wave tube
[AD-739542] N72-27244

TENNESSEE UNIV., KNOXVILLE.
A study of strapdown platform technology
[NASA-CR-123710] N72-27673
Introduction
N72-27674
Rebalance loop analysis
N72-27675
Strapdown platforms using redundant two-degree-of-freedom gyros
N72-27676
DAA realizations of attitude algorithms
N72-27677
Rebalance electronics
N72-27678

TENNESSEE UNIV., TULLAHOMA.
Pollutant production in a simulated turbojet afterburner. Part 1: Experimental and theoretical study
[AD-739176] N72-27968
Pollutant production in a simulated turbojet afterburner. Part 2: Computer program for calculation of pollutant history in afterburning turbojet engines
[AD-739177] N72-27969

TETRA TECH, INC., PASADENA, CALIF.
Studies of excited hydrogen in relation to advanced propulsion
[AD-739524] N72-27165

TEXAS A&M UNIV., COLLEGE STATION.
Criteria for evaluating the applicability of composite material shafts to helicopter drive systems
[AD-739429] N72-27043
A study of the effects of illumination and noise on simple motor performance
[AD-739474] N72-27095
A dynamic analysis of the arm complex subjected to an external load
[AD-739478] N72-27096
The effects of combined environmental factors on human performance of a manual task: Noise and temperature
[AD-739432] N72-27097
Techniques for measurement of centers of gravity
[AD-739439] N72-27136
Psychophysiological measurements applied to maintainability evaluation of equipment design
[AD-739437] N72-27137
Investigation of stimulus-signal amplitude and frequency variation in vibrotactile communication
[AD-739433] N72-27139
Self-repairing computers
[AD-739417] N72-27224
Maintenance time comparison of transistors versus tubes
[AD-739476] N72-27239
Digital fluidic systems laboratory proposal
[AD-739430] N72-27476
A comparison of visual and auditory displays as check out indicators
[AD-739475] N72-27477
Reliability analysis of a parallel standby system
[AD-739477] N72-27542
Tests of plastic encapsulated semiconductors
[AD-739473] N72-27806

TEXAS TECHNOLOGICAL UNIV., LUBBOCK.
Monitoring performance across sense modes: An individual differences approach
[AD-737735] N72-27089
Smooth empirical Bayes estimation of observation error variances in linear systems
[NASA-CR-127527] N72-27620

TEXAS UNIV., ARLINGTON.
A study of magnetic transition properties in the CoS[2-x]Se[x] family using pyromagnetic detection method
[AD-739336] N72-27798

TEXAS UNIV., AUSTIN.
ATS-5 signal characteristics at 15.3 GHz and related experiments at 15 and 35 GHz. Part 1: Basic features of the experiments and primary results
[NASA-CR-122438] N72-27174
The linear polarization of lunar thermal emission at 3.1 mm wavelength
[NASA-CR-127273] N72-27848

TOKYO UNIV. OF EDUCATION (JAPAN).
Pion pion, pion kaon, and kaon antikaon distributions in the pionization region
[TUEP-72-17] N72-27762

TORONTO UNIV. (ONTARIO).
Vibration of cylindrical shells by a hybrid finite element method
N72-27954

TOULOUSE UNIV. (FRANCE).
Contribution to the study of boron atom diffusion in silicon
[PUBL-884] N72-27600

TRANSLATION CONSULTANTS, LTD., ARLINGTON, VA.
The existence and activity of thryocalcitonin in man
[NASA-TT-F-14341] N72-27079
Gas chromatography determination of alcohols and mercaptans
[NASA-TT-F-14348] N72-27153
Interaction of an elastic boundary with the viscous sublayer of a turbulent boundary layer
[NASA-TT-F-14391] N72-27315
The difference problem with an oblique derivative in the half plane
[NASA-TT-F-14346] N72-27617
Air ionization measurements in different meteorological and environmental conditions
[NASA-TT-F-14408] N72-27642

TRW SYSTEMS GROUP, REDONDO BEACH, CALIF.
Potential techniques and development activities in diver suit heating
N72-27122
Electrostatic instability of ring current protons beyond the plasmapause during injection events
[NASA CR-122447] N72-27347

TRW SYSTEMS, REDONDO BEACH, CALIF.
Cross field current driven ion acoustic instability
[NASA-CR-127272] N72-27771
TURKU UNIV. [FINLAND].
An electron gun for auger and ultrasoft X-ray apparatus
[PB-207208] N72-27240

U

UNITED AIRCRAFT CORP., EAST HARTFORD, CONN.
An investigation of the quantitative applicability of model helicopter rotor wake patterns obtained from a water tunnel
[AD-739946] N72-27052
UNITED TECHNOLOGY CENTER, SUNNYVALE, CALIF.
Study of solid rocket motors for a space shuttle booster, volume 2
[NASA-CR-127416] N72-27821
UNIVERSITY OF SOUTHERN CALIF., LOS ANGELES.
New methods for growth and characterization of GaAs and mixed III-V semiconductor crystals
[AD-739374] N72-27807
UTAH UNIV., SALT LAKE CITY.
A high-heating-rate thermal analysis of solid-propellant reactions
N72-27813

V

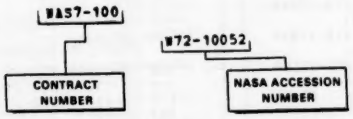
VEREINIGTE OESTERREICHISCHE EISEN- UND STAHLWERKE A.G., LINZ [AUSTRIA].
Improved design of welded LD converters
N72-27508
VIRGINIA POLYTECHNIC INST., BLACKSBURG.
Convective heat and mass transfer from water surfaces
[PB-207638] N72-27660
VIRGINIA UNIV., CHARLOTTESVILLE.
Convective heat and mass transfer from water surfaces
[PB-207638] N72-27660
VON KARMAN INST. FOR FLUID DYNAMICS, RHODE-SAINT-GENESE [BELGIUM].
Introductory remarks
N72-27294
Drag coefficients of spheres in hypersonic non-continuum flow
[AD-739250] N72-27327
Influence of a local obstruction on heat transfer in packed beds
[VKI-TN-80] N72-27725
VOUGHT MISSILES AND SPACE CO., DALLAS, TEX.
Regenerable thermal control and carbon dioxide control techniques for use in advanced extravehicular protective systems
N72-27114

W

WASHINGTON UNIV., SEATTLE.
Intersecting all edges of centrally symmetric polyhedra by planes
[AD-739711] N72-27628
WATERVLIET ARSENAL, N.Y.
The role of carbide morphology on low cycle fatigue behavior of iron-carbon alloys
[AD-739508] N72-27592
WELDING INST., CAMBRIDGE [ENGLAND].
Improving Welded Product Design. Volume 1: Papers
N72-27491
Some metallurgical factors to be considered for the design and fabrication of equipment exposed to hydrogen environments
N72-27494
Design to avoid brittle fracture in welded structures
N72-27495
The proposed new code of practice for the design of welded structures subject to fatigue loading
N72-27498
Training for welding design
N72-27502
Successful and profitable electron-beam welding on small components
N72-27504
Heat exchanger tube-to-tubeplate joints for thin walled tubes
N72-27506
Some case studies in welded structure design
N72-27509
Optimum detail design based upon strain measurements in service
N72-27510
Proceedings of the conference on Improving Welded Product Design. Volume 2: Discussions
N72-27511
WELDING RESEARCH INST. [VUS], BRATISLAVA [CZECHOSLOVAKIA].
Resistance projection welding of large cross-sections and machine component design
N72-27507
WHESSOE LTD., DARLINGTON [ENGLAND].
Influence of design criteria on material costs
N72-27492
WESTINGHOUSE ELECTRIC CORP., ANNAPOLIS, MD.
A chlorate candle/lithium hydroxide personal breathing apparatus
N72-27112
A portable life support system for use in mines
N72-27115
WESTINGHOUSE ELECTRIC CORP., BALTIMORE, MD.
Summary of moderate depth lunar drill development program from its conception to 1 July 1972
[NASA-CR-123724] N72-27526
WHITTAKER CORP., WALTHAM, MASS.
Developments in modelling visual-vestibular interactions
[AD-737795] N72-27090
WISCONSIN UNIV., MADISON.
On optimizing the treatment of exchange perturbations
[NASA-CR-127265] N72-27154
Layered recognition networks that pre-process, classify, and describe
[NASA-CR-127266] N72-27208
Natural convection in an enclosure with localized heating from below
[PB-208111] N72-27334
Meteorological measurements from satellite platforms
[NASA-CR-122437] N72-27646
WINDCO: An interactive system for obtaining accurate cloud motions from geostationary satellite spin scan camera pictures
N72-27647
ATS-3 observed cloud brightness field related to meso- to subsynoptic-scale rainfall pattern
N72-27648
Cloud photographs from satellites as a hydrological tool in remote tropical regions
N72-27649
Design of a small radar altimeter for balloon payloads
N72-27650
Averaged pulse shape measurements of radar sea return at near-vertical incidence
N72-27651
Properties of tropical cloud clusters determined from geostationary satellite pictures
N72-27652
Optimal utilization of total elastic scattering cross section data for the determination of interatomic potentials
[NASA-CR-127258] N72-27755
Impulsive model for reactive collisions
[NASA-CR-127260] N72-27756
Entropy and chemical change. 1: Characterization of product [and reactant] energy distributions in reactive molecular collisions: Information and enthropy deficiency
[NASA-CR-127261] N72-27757
Solar wind physics
[NASA-CR-127274] N72-27831

CONTRACT NUMBER INDEX

Typical Contract Number Index Listing



Listings in this index are arranged alphanumerically by contract number. Under each contract number, the NASA accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order. The NASA accession number denotes the number by which the citation is identified.

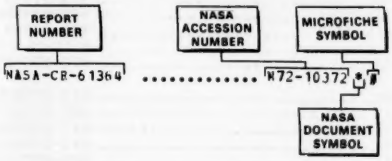
AF PROJ. AAH9
N72-27333
AF PROJ. 7JJ N72-27743
AF PROJ. 649L
N72-27258
AF PROJ. 684B
N72-27279
AF PROJ. 1347
N72-27480
AF PROJ. 1366
N72-27332
AF PROJ. 1370
N72-27330
AF PROJ. 3066
N72-27968
N72-27969
AF PROJ. 3141
N72-27827
AF PROJ. 4643
N72-27840
AF PROJ. 5573
N72-27257
AF PROJ. 5621
N72-27801
AF PROJ. 6065
N72-27046
AF PROJ. 6112
N72-27474
AF PROJ. 6670
N72-27327
AF PROJ. 6687
N72-27664
AF PROJ. 6690
N72-27473
AF PROJ. 7023
N72-27166
AF PROJ. 7064
N72-27335
AF PROJ. 7065
N72-27971
AF PROJ. 7071
N72-27626
AF PROJ. 7116
N72-27070
AF PROJ. 7184
N72-27138
AF PROJ. 7222
N72-27094
AF PROJ. 7231
N72-27090
N72-27093
AF PROJ. 7343
N72-27329
N72-27534
N72-27535
N72-27537
N72-27539
N72-27581
N72-27582
N72-27605
N72-27607
AF PROJ. 7351
N72-27587
AF PROJ. 7353
N72-27957
AF PROJ. 7381
N72-27604
AF PROJ. 7600
N72-27402
AF PROJ. 7628
N72-27711
AF PROJ. 7755
N72-27086
N72-27192
AF PROJ. 7784
N72-27087
AF PROJ. 7885
N72-27810
AF PROJ. 7996
N72-27091
AF PROJ. 8219
N72-27039
AF PROJ. 8605
N72-27473
AF PROJ. 8608
N72-27482
AF PROJ. 8692
N72-27901
AF PROJ. 9749
N72-27135
N72-27627
N72-27629
AF PROJ. 9750
N72-27165
AF PROJ. 9751
N72-27782
AF PROJ. 9764
N72-27800
N72-27804
AF PROJ. 9782
N72-27958
AF-AFOSR-1259-67
N72-27809
AF-AFOSR-1261-67
N72-27629
AF-AFOSR-1496-68
N72-27782
AF-AFOSR-1527-68
N72-27958
AF-AFOSR-1545-68
N72-27800
ARO PROJ. RC1261
N72-27828
ARPA ORDER 189
N72-27779
ARPA ORDER 306
N72-27552
ARPA ORDER 529
N72-27301
ARPA ORDER 600
N72-27193
ARPA ORDER 1316
N72-27387
ARPA ORDER 1348
N72-27404
ARPA ORDER 1366
N72-27901
ARPA ORDER 1380
N72-27225
ARPA ORDER 1607
N72-27404
ARPA ORDER 1608
N72-27580
ARPA ORDER 1618
N72-27481
ARPA ORDER 1620
N72-27396
N72-27397
N72-27398
ARPA ORDER 1623
N72-27807
ARPA ORDER 1702
N72-27162
ARPA ORDER 1714
N72-27393
N72-27394
ARPA ORDER 1722
N72-27387
ARPA ORDER 1730
N72-27404
ARPA ORDER 1752
N72-27669
AT(04-3)-34 N72-27347
N72-27770
N72-27771
B/SR/8362 N72-27419
CA-12369 N72-27157
DA PROJ. 1F1-62203-A-141
N72-27045
DA PROJ. 1F1-62204-A-142
N72-27052
DA PROJ. 1G1-62203-D-144
N72-27047
DA PROJ. 1M2-62303-A-214
N72-27260
DA PROJ. 1T0-61102-A-34-A
N72-27242
DA PROJ. 1T0-61102-B-31-A
N72-27783
DA PROJ. 1T0-61102-B-53-A
N72-27403
DA PROJ. 1T0-61102-B-81-A
N72-27668
DA PROJ. 1T0-62105-A-328
N72-27592
DA PROJ. 1T0-62111-A-026
N72-27666
DA PROJ. 1T0-62111-A-126
N72-27042
N72-27282
DA PROJ. 1T6-62705-A-053
N72-27071
N72-27072
N72-27073
DA PROJ. 1W2-6301-A-301
N72-27194
DA PROJ. 1W5-62604-A-607
N72-27591
DA PROJ. 1X2-63302-D-212
N72-27195
N72-27223
DA-ARO(D)-31-G179
N72-27154
DAAB07-68-C-0083
N72-27668
DAAB07-70-C-0154
N72-27244
DAAD05-69-C-0102
N72-27089
DAAF01-72-C-0130
N72-27611
DAAJ02-68-C-0039
N72-27045
DAAJ02-69-C-0036
N72-27045
DAAJ02-70-C-009
N72-27052
DAAJ02-70-C-0030
N72-27047
DAAJ02-70-C-0046
N72-27069
DAHC04-69-C-0077
N72-27302
DAHC04-71-C-0018
N72-27669
DAHC15-67-C-0141
N72-27779
DAHC15-69-C-0285
N72-27225
DAHC15-70-C-0283
N72-27580
DAHC15-70-G-14
N72-27807
DAHC15-71-G-6
N72-27807
DASA01-71-C-0041
N72-27478
DOT-FA70WA-2141
N72-27710
DOT-FA70WA-2267
N72-27709
DOT-FA70WA-2322
N72-27085
DOT-FA71WA-2555
N72-27050
DOT-FR-7-35248
N72-27238
DRME-70/126 N72-27471
DSA900-72-C-1182
N72-27037
N72-27742
N72-27799
ESOC-219/70/AS
N72-27625
ESTEC-1458-71-CG
N72-27707
FAA PROJ. AM-A-71-PRS-37
N72-27011
FAA PROJ. AM-A-72-PRS-37
N72-27011
FAA PROJ. 072-324-12X
N72-27702
FAA PROJ. 320-111-01X
N72-27694
FTD PROJ. 7JJ
N72-27744
F04701-71-C-0172
N72-27163
N72-27395
N72-27405
N72-27475
N72-27479
N72-27609
N72-27610
N72-27712
N72-27746
N72-27902
N72-27940
F19628-68-C-0180
N72-27190
F19628-68-C-0358
N72-27473
F19628-69-C-0127
N72-27402
F19628-70-C-0046
N72-27901
N72-27901
F19628-70-C-0230
N72-27193
N72-27258
F19628-70-C-0260
N72-27482
F30602-69-C-0051
N72-27196
N72-27197
N72-27198
N72-27199
N72-27200
F30602-71-C-0099
N72-27257
F30602-71-C-0110
N72-27259
F33615-67-C-1027
N72-27810
F33615-67-C-1157
N72-27279
F33615-68-C-1227
N72-27046
F33615-68-C-1647
N72-27138
F33615-69-C-1062
N72-27166
F33615-69-C-1113
N72-27070
F33615-69-C-1298
N72-27480

F33615-69-C-1425 N72-27090
F33615-71-C-1065 N72-27039
F33615-71-C-1125 N72-27968 N72-27969
F33615-71-C-1143 N72-27604
F33615-71-C-1308 N72-27957
F33657-70-C-0941 N72-27393
F33657-71-C-0510 N72-27396 N72-27397 N72-27398
F33657-71-C-0859 N72-27162
F33657-72-C-0009 N72-27394
F40600-72-C-0003 N72-27828
F41609-69-C-0058 N72-27078
F44620-68-C-0021 N72-27627
F44620-69-C-0080 N72-27165
F44620-71-C-0028 N72-27387
F44620-71-C-0093 N72-27135
F44620-71-C-0128 N72-27481
F61052-68-C-0039 N72-27741
F61052-69-C-0024 N72-27327
F61052-70-C-0005 N72-27320
GH-15896 N72-27214
HE-3532 N72-27078
JPL-950403 N72-27167
MH-12266 N72-27208
NASA ORDER L-58514 N72-27149
NASA ORDER R-09-020-015 N72-27352
NASA ORDER R-36-015-001 N72-27077
NASA ORDER T-80485C N72-27353
NASA ORDER T-90485C N72-27351
NASA ORDER W-12570 N72-27422
NASA ORDER W-12996 N72-27375
NASA ORDER W-13300 N72-27730
NASW-1395 N72-27424
NASW-1844 N72-27577
NASW-2035 N72-27081 N72-27152 N72-27170 N72-27172 N72-27229 N72-27314 N72-27640 N72-27719 N72-27750 N72-27751 N72-27752 N72-27832
NASW-2036 N72-27207 N72-27616
NASW-2037 N72-27354 N72-27530 N72-27576 N72-27754
NASW-2038 N72-27079 N72-27153 N72-27315 N72-27617 N72-27642
NASW-2170 N72-27985
NASW-2248 N72-27846
NASW-2312 N72-27913 N72-27914
NASW-2357 N72-27347
NAS1-2973 N72-27776
NAS1-6367 N72-27527
NAS1-8141 N72-27350 N72-27350 N72-27776
NAS1-9711 N72-27104
NAS1-10174 N72-26996
NAS1-10839 N72-27173
NAS1-10873 N72-27876 N72-27877 N72-27878 N72-27879
NAS1-10990 N72-27922
NAS2-5519 N72-27065 N72-27066
NAS2-5603 N72-27853 N72-27863
NAS2-6433 N72-27032
NAS3-10477 N72-27819
NAS3-11157 N72-27818
NAS3-13499 N72-27290
NAS3-14408 N72-27054 N72-27064
NAS3-15327 N72-27792
NAS5-9074 N72-27776
NAS5-9076 N72-27835
NAS5-10387 N72-27174
NAS5-10625 N72-27350 N72-27776
NAS5-11039 N72-27776
NAS5-11255 N72-27736
NAS5-11445 N72-27933 N72-27934
NAS5-11480 N72-27168
NAS5-11487 N72-27231
NAS5-11542 N72-27646
NAS5-20168 N72-27701
NAS7-100 N72-27167 N72-27176 N72-27249 N72-27251 N72-27358 N72-27850 N72-27855 N72-27857 N72-27858 N72-27859 N72-27862 N72-27875 N72-27964
NAS7-746 N72-27151
NAS8-4016 N72-27923 N72-27924 N72-27925 N72-27926 N72-27927 N72-27928 N72-27929 N72-27930 N72-27935
NAS8-21804 N72-27680 N72-27920
NAS8-25140 N72-27912
NAS8-25619 N72-27911
NAS8-25848 N72-27717 N72-27718
NAS8-26487 N72-27526
NAS8-27296 N72-27673
NAS8-27364 N72-27204
NAS8-27386 N72-27515
NAS8-27539 N72-27919
NAS8-27969 N72-27363
NAS9-10441 N72-27218 N72-27219
NAS9-10950 N72-27215
NAS12-686 N72-27250
NBS PROJ. 27500-2750400 N72-27730
NBS PROJ. 27503-2750430 N72-27730
NBS PROJ. 27503-2750438 N72-27730
NBS PROJ. 27505-2750550 N72-27730
NBS PROJ. 27506-2750460 N72-27730
NBS-32-70-5 N72-27790
NGL-05-020-007 N72-27679
NGL-05-020-243 N72-27945
NGL-16-001-002 N72-27350 N72-27776
NGL-21-002-008 N72-27206 N72-27346
NGL-34-001-001 N72-27230
NGL-44-012-006 N72-27848
NGL-50-002-001 N72-27154 N72-27755 N72-27756 N72-27757
NGR-005-002-114 N72-27861
NGR-05-002-256 N72-27358
NGR-05-007-116 N72-27347 N72-27770 N72-27771
NGR-05-007-190 N72-27347 N72-27770 N72-27771
NGR-05-007-276 N72-27167
NGR-05-020-559 N72-27370 N72-27834
NGR-06-003-083 N72-27252 N72-27253
NGR-06-004-058 N72-27376
NGR-09-015-002 N72-27361
NGR-14-001-103 N72-27847
NGR-14-001-148 N72-27645
NGR-14-005-002 N72-27345 N72-27369
NGR-14-005-103 N72-27084 N72-27124
NGR-14-005-111 N72-27205
NGR-19-001-024 N72-27082
NGR-21-002-216 N72-27550
NGR-24-003-001 N72-27078
NGR-24-005-180 N72-27376
NGR-27-001-035 N72-27358
NGR-36-027-019 N72-27575
NGR-39-011-002 N72-27761
NGR-44-011-040 N72-27620
NGR-50-002-160 N72-27208
NGR-50-002-162 N72-27831
NONR-839(34) N72-27303 N72-27304
NONR-839(38) N72-27301
NONR-1509(03) N72-27655
NONR-5037(01) N72-27748
NR PROJ. 015-630 N72-27554
NR PROJ. 016-107 N72-27553
NR PROJ. 031-718 N72-27589 N72-27593
NR PROJ. 044-353 N72-27628
NR PROJ. 215-188 N72-27713
NR PROJ. 293-005 N72-27404
NR PROJ. 323-003 N72-27370 N72-27834
NSF GA-1592 N72-27853 N72-27863
NSF GA-10999 N72-27376
NSF GA-11088 N72-27645
NSF GA-11415 N72-27865
NSF GA-14029 N72-27853 N72-27863
NSF GA-20470 N72-27643 N72-27644 N72-27645
NSF GA-28190X N72-27643 N72-27644 N72-27645
NSF GA-31138 N72-27370 N72-27834
NSF GB-16665 N72-27755 N72-27756
NSF GI-44 N72-27618
NSF GJ-583 N72-27208
NSF GJ-32258X N72-27216
NSF GP-8748 N72-27623 N72-27765 N72-27766 N72-27768
NSF GP-8784 N72-27622
NSF GP-22817 N72-27347 N72-27770 N72-27771
NSF GP-23764 N72-27154
NSF GP-25303 N72-27758
NSF GP-26014 N72-27756 N72-27757
NSF GP-27304 N72-27358
NSF GP-28027 N72-27358
NSF GP-28862 N72-27621
NSF GP-30400X N72-27861
NSF GU-2061 N72-27764 N72-27767
NSR-09-012-903 N72-27055
NSR-09-046-001 N72-27986
NSR-21-002-077 N72-27346
NSR-21-002-096 N72-27364
NSR-24-005-062 N72-27849
N00014-67-A-0094-0019 N72-27861
N00014-67-A-0103-0003 N72-27628
N00014-67-A-0112-0033 N72-27553
N00014-67-A-0112-0068 N72-27370 N72-27834
N00014-67-A-0113-0010 N72-27243
N00014-67-A-0126-0014 N72-27798
N00014-67-A-0232-0006 N72-27590
N00014-67-A-0239-0021 N72-27206
N00014-67-C-0439 N72-27589 N72-27593
N00014-68-A-0196-0003 N72-27350

N72-27776
N72-27835
N00014-68-C-0110 N72-27554
N00014-69-A-0200 N72-27770
N72-27771
N00014-69-A-0200-4023 N72-27347
N00014-69-A-0200-6012 N72-27404
N00014-69-A-0220-0004 N72-27748
N00014-69-C-0296 N72-27747
N00014-70-C-0013 N72-27236
N00014-70-C-0072 N72-27116
N00014-71-C-0049 N72-27552
N00014-71-C-0265 N72-27713
N00014-71-C-0318 N72-27044
N00014-71-C-0322 N72-27201
N00019-70-C-0205 N72-27608
N00019-71-C-0425 N72-27546
N00156-70-C-1321 N72-27040
OWRR-B-021-VA(3) N72-27660
PRO-Y-72-827 N72-27801
PROJ. THEMIS N72-27668
PROJ. 157 N72-27347
T-832-1-203 N72-27188
T-91346 N72-27189
USGS-14-08-0001-10848 N72-27422
113-31 N72-27965
117-07-01-01 N72-27312
129-04-20-01-00-21 N72-27313
134-03-20 N72-27575
135-19-02-04 N72-27024
136-13-05-01 N72-27311
136-62-01-00-24 N72-27013
136-62-02-03 N72-27033
185-47-32-02-72 N72-27349
186-68-50-01-51 N72-27732
501-06-10-05 N72-27002
741-72 N72-27817
760-74-05-01 N72-27010
764-74 N72-27014
764-74-02-02 N72-26997

REPORT/ACCESSION NUMBER INDEX

Typical Report/Accession Number Index Listing



Listings in this index are arranged alphanumerically by report number. The NASA accession number denotes the number by which the citation is identified. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche. A plus sign (+) indicates a document that cannot be microfiched but for which one-to-one facsimile is available.

A-N99-1972 ..... N72-27371 #

A-4180 ..... N72-27024*#
A-4224 ..... N72-27313*#

AC-144 ..... N72-27473 #

ACRL-IP-172 ..... N72-27711 #

ACSI-K-0856 ..... N72-27988 #

AD-731412 ..... N72-27770*#
AD-734692 ..... N72-27771*#
AD-736973 ..... N72-27608 #
AD-737544 ..... N72-27902 #
AD-737568 ..... N72-27091 #
AD-737588 ..... N72-27406 #
AD-737589 ..... N72-27541 #
AD-737643 ..... N72-27092 #
AD-737700 ..... N72-27088 #
AD-737735 ..... N72-27089 #
AD-737795 ..... N72-27090 #
AD-737798 ..... N72-27138 #
AD-737799 ..... N72-27402 #
AD-737826 ..... N72-27093 #
AD-737828 ..... N72-27094 #
AD-738016 ..... N72-27005 #
AD-738287 ..... N72-27840 #
AD-738446 ..... N72-27606 #
AD-738450 ..... N72-27584 #
AD-738452 ..... N72-27038 #
AD-738458 ..... N72-27236 #
AD-738476 ..... N72-27404 #
AD-738477 ..... N72-27543 #
AD-738489 ..... N72-27552 #
AD-738623 ..... N72-27332 #
AD-738625 ..... N72-27039 #
AD-738627 ..... N72-27086 #
AD-738628 ..... N72-27192 #
AD-738629 ..... N72-27087 #
AD-738632 ..... N72-27193 #
AD-738633 ..... N72-27782 #
AD-738680 ..... N72-27709 #
AD-738681 ..... N72-27939 #
AD-738683 ..... N72-27938 #
AD-738694 ..... N72-27191 #
AD-738737 ..... N72-27161 #
AD-738739 ..... N72-27781 #
AD-738746 ..... N72-27539 #
AD-738748 ..... N72-27474 #
AD-738892 ..... N72-27710 #
AD-738900 ..... N72-27040 #
AD-738983 ..... N72-27987 #
AD-739169 ..... N72-27664 #
AD-739172 ..... N72-27398 #
AD-739173 ..... N72-27397 #
AD-739174 ..... N72-27396 #
AD-739176 ..... N72-27968 #
AD-739177 ..... N72-27969 #
AD-739178 ..... N72-27393 #
AD-739181 ..... N72-27394 #
AD-739182 ..... N72-27711 #
AD-739184 ..... N72-27395 #
AD-739185 ..... N72-27746 #
AD-739186 ..... N72-27475 #
AD-739187 ..... N72-27163 #
AD-739188 ..... N72-27804 #
AD-739189 ..... N72-27827 #
AD-739191 ..... N72-27828 #
AD-739196 ..... N72-27901 #
AD-739197 ..... N72-27162 #
AD-739198 ..... N72-27801 #
AD-739202 ..... N72-27473 #
AD-739203 ..... N72-27190 #
AD-739204 ..... N72-27604 #
AD-739205 ..... N72-27329 #
AD-739206 ..... N72-27607 #
AD-739208 ..... N72-27744 #
AD-739209 ..... N72-27537 #
AD-739210 ..... N72-27328 #
AD-739211 ..... N72-27068 #
AD-739212 ..... N72-27538 #
AD-739213 ..... N72-27237 #
AD-739214 ..... N72-27331 #
AD-739215 ..... N72-27585 #
AD-739219 ..... N72-27586 #
AD-739221 ..... N72-27658 #
AD-739222 ..... N72-27330 #
AD-739223 ..... N72-27803 #
AD-739226 ..... N72-27587 #
AD-739229 ..... N72-27988 #
AD-739230 ..... N72-27279 #
AD-739239 ..... N72-27657 #
AD-739245 ..... N72-27802 #
AD-739248 ..... N72-27222 #
AD-739250 ..... N72-27327 #
AD-739253 ..... N72-27741 #
AD-739255 ..... N72-27160 #
AD-739258 ..... N72-27135 #
AD-739259 ..... N72-27800 #
AD-739260 ..... N72-27387 #
AD-739276 ..... N72-27581 #
AD-739277 ..... N72-27582 #
AD-739278 ..... N72-27534 #
AD-739279 ..... N72-27535 #
AD-739280 ..... N72-27743 #
AD-739282 ..... N72-27536 #
AD-739284 ..... N72-27605 #
AD-739285 ..... N72-27583 #
AD-739286 ..... N72-27805 #
AD-739289 ..... N72-27533 #
AD-739290 ..... N72-27780 #
AD-739291 ..... N72-27665 #
AD-739292 ..... N72-27970 #
AD-739293 ..... N72-27333 #
AD-739294 ..... N72-27281 #
AD-739301 ..... N72-27588 #
AD-739309 ..... N72-27085 #
AD-739312 ..... N72-27726 #
AD-739318 ..... N72-27326 #
AD-739321 ..... N72-27740 #
AD-739323 ..... N72-27654 #
AD-739324 ..... N72-27779 #
AD-739325 ..... N72-27067 #
AD-739326 ..... N72-27278 #
AD-739331 ..... N72-27036 #
AD-739336 ..... N72-27798 #
AD-739337 ..... N72-27655 #
AD-739340 ..... N72-27580 #
AD-739341 ..... N72-27540 #
AD-739355 ..... N72-27812 #
AD-739356 ..... N72-27037 #
AD-739357 ..... N72-27388 #
AD-739358 ..... N72-27656 #
AD-739359 ..... N72-27799 #
AD-739360 ..... N72-27742 #
AD-739364 ..... N72-27667 #

AD-739365 ..... N72-27589 #
AD-739370 ..... N72-27044 #
AD-739372 ..... N72-27478 #
AD-739374 ..... N72-27807 #
AD-739377 ..... N72-27553 #
AD-739383 ..... N72-27243 #
AD-739384 ..... N72-27747 #
AD-739390 ..... N72-27546 #
AD-739395 ..... N72-27590 #
AD-739417 ..... N72-27224 #
AD-739429 ..... N72-27043 #
AD-739430 ..... N72-27476 #
AD-739432 ..... N72-27097 #
AD-739433 ..... N72-27139 #
AD-739437 ..... N72-27137 #
AD-739439 ..... N72-27136 #
AD-739464 ..... N72-27041 #
AD-739473 ..... N72-27806 #
AD-739474 ..... N72-27095 #
AD-739475 ..... N72-27477 #
AD-739476 ..... N72-27239 #
AD-739477 ..... N72-27542 #
AD-739478 ..... N72-27096 #
AD-739480 ..... N72-27069 #
AD-739481 ..... N72-27194 #
AD-739482 ..... N72-27242 #
AD-739484 ..... N72-27282 #
AD-739485 ..... N72-27666 #
AD-739486 ..... N72-27403 #
AD-739487 ..... N72-27042 #
AD-739488 ..... N72-27071 #
AD-739489 ..... N72-27072 #
AD-739490 ..... N72-27073 #
AD-739491 ..... N72-27783 #
AD-739492 ..... N72-27940 #
AD-739494 ..... N72-27609 #
AD-739495 ..... N72-27405 #
AD-739498 ..... N72-27610 #
AD-739500 ..... N72-27712 #
AD-739501 ..... N72-27140 #
AD-739503 ..... N72-27260 #
AD-739504 ..... N72-27989 #
AD-739508 ..... N72-27592 #
AD-739510 ..... N72-27611 #
AD-739512 ..... N72-27195 #
AD-739513 ..... N72-27223 #
AD-739516 ..... N72-27591 #
AD-739518 ..... N72-27626 #
AD-739520 ..... N72-27164 #
AD-739524 ..... N72-27165 #
AD-739525 ..... N72-27627 #
AD-739526 ..... N72-27196 #
AD-739527 ..... N72-27197 #
AD-739528 ..... N72-27198 #
AD-739529 ..... N72-27199 #
AD-739530 ..... N72-27200 #
AD-739541 ..... N72-27669 #
AD-739542 ..... N72-27244 #
AD-739543 ..... N72-27259 #
AD-739544 ..... N72-27668 #
AD-739547 ..... N72-27070 #
AD-739548 ..... N72-27258 #
AD-739549 ..... N72-27257 #
AD-739550 ..... N72-27479 #
AD-739554 ..... N72-27046 #
AD-739555 ..... N72-27047 #
AD-739556 ..... N72-27480 #
AD-739557 ..... N72-27957 #
AD-739559 ..... N72-27045 #
AD-739685 ..... N72-27245 #
AD-739686 ..... N72-27202 #
AD-739687 ..... N72-27048 #
AD-739689 ..... N72-27714 #
AD-739691 ..... N72-27808 #
AD-739695 ..... N72-27283 #
AD-739696 ..... N72-27593 #
AD-739699 ..... N72-27098 #
AD-739703 ..... N72-27748 #
AD-739705 ..... N72-27225 #
AD-739708 ..... N72-27201 #
AD-739711 ..... N72-27628 #
AD-739713 ..... N72-27713 #
AD-739715 ..... N72-27554 #
AD-739864 ..... N72-27335 #
AD-739865 ..... N72-27166 #
AD-739866 ..... N72-27971 #
AD-739867 ..... N72-27810 #
AD-739868 ..... N72-27482 #
AD-739869 ..... N72-27051 #

AD-739870 ..... N72-27050 #
AD-739946 ..... N72-27052 #
AD-739973 ..... N72-27990 #
AD-739974 ..... N72-27991 #
AD-739975 ..... N72-27481 #
AD-739976 ..... N72-27958 #
AD-739978 ..... N72-27809 #
AD-739983 ..... N72-27629 #

AEDC-TR-72-13 ..... N72-27828 #

AERONOMICA-ACTA-A-102 ..... N72-27372 #

AFAPL-TR-71-65 ..... N72-27827 #
AFAPL-TR-71-66-PT-1 ..... N72-27968 #
AFAPL-TR-71-66-PT-2 ..... N72-27969 #

AFCRL-ERP-376 ..... N72-27664 #

AFCRL-71-0420 ..... N72-27482 #
AFCRL-71-0551 ..... N72-27402 #
AFCRL-71-0558 ..... N72-27840 #
AFCRL-71-0594 ..... N72-27901 #
AFCRL-71-0599 ..... N72-27711 #
AFCRL-71-0602 ..... N72-27664 #
AFCRL-72-0033 ..... N72-27473 #
AFCRL-72-0037 ..... N72-27801 #
AFCRL-72-0051 ..... N72-27190 #
AFCRL-72-0069 ..... N72-27741 #
AFCRL-72-0126 ..... N72-27327 #

AFFDL-TR-71-77 ..... N72-27279 #
AFFDL-TR-71-87 ..... N72-27332 #
AFFDL-TR-71-95 ..... N72-27046 #
AFFDL-TR-71-101 ..... N72-27480 #
AFFDL-TR-71-134 ..... N72-27039 #

AFML-TR-71-253 ..... N72-27604 #
AFML-TR-71-263 ..... N72-27957 #

AFOSR-71-1860TR ..... N72-27958 #
AFOSR-72-0474TR ..... N72-27804 #
AFOSR-72-0504TR ..... N72-27165 #
AFOSR-72-0536TR ..... N72-27800 #
AFOSR-72-0571TR ..... N72-27782 #
AFOSR-72-0594TR ..... N72-27809 #
AFOSR-72-0608TR ..... N72-27481 #
AFOSR-72-0612TR ..... N72-27387 #
AFOSR-72-0616TR ..... N72-27135 #
AFOSR-72-0710TR ..... N72-27627 #
AFOSR-72-0742TR ..... N72-27629 #

AGARD-AR-44 ..... N72-27811 #

AGARD-BULL-72-2 ..... N72-27976 #

AGARD-LS-48 ..... N72-27293 #
AGARD-LS-52 ..... N72-27681 #
AGARD-LS-53 ..... N72-27016 #

AIL-9206-1 ..... N72-27709 #

AMRL-TR-67-41 ..... N72-27093 #
AMRL-TR-71-14 ..... N72-27090 #
AMRL-TR-71-29 ..... N72-27140 #
AMRL-TR-71-59 ..... N72-27094 #
AMRL-TR-71-80 ..... N72-27138 #

AOEL-26 ..... N72-27404 #

APR-4 ..... N72-27668 #

APS-PH-84 ..... N72-27240 #

AR-1 ..... N72-27985*#
AR-3 ..... N72-27367 #
AR-10 ..... N72-27979 #

ARC-CP-1198 ..... N72-27004 #

ARL-71-11/FAA-71-1 ..... N72-27085 #
ARL-71-0252 ..... N72-27335 #
ARL-71-0264 ..... N72-27626 #
ARL-71-0285 ..... N72-27166 #
ARL-71-0286 ..... N72-27971 #
ARL-71-0290 ..... N72-27810 #
ARL-71-0318 ..... N72-27070 #

ARL/A-NOTE-334 ..... N72-27426 #

ARL/MET-87 ..... N72-27601 #

AROD-9951-1 ..... N72-27669 #

ASAO-PR20020-2 ..... N72-27701*#

BM-IC-8523 ..... N72-27155 #
BM-IC-8530 ..... N72-27348 #

BM-RI-7650 ..... N72-27420 #

BMBW-FB-W-71-33 ..... N72-27229*#

BMVG-FBWT-F1-8 ..... N72-27719*#

BRL-MR-2155 ..... N72-27005 #
BRL-MR-2158 ..... N72-27164 #

BR26163 ..... N72-27602 #
BR26903 ..... N72-27900 #
BR26986 ..... N72-27897 #
BR27218 ..... N72-27277 #
BR27694 ..... N72-27159 #
BR27730 ..... N72-27158 #
BR28255 ..... N72-27898 #
BR28286 ..... N72-27899 #

CE-BIBL-224 ..... N72-27321 #

CP-31 ..... N72-27775 #
CP-32 ..... N72-27774 #
CP-33 ..... N72-27773 #
CP-34 ..... N72-27275 #
CP-35 ..... N72-27319 #
CP-36 ..... N72-27772 #

DESY-71/57 ..... N72-27794 #

DGS-165 ..... N72-27402 #

DHM-11440 ..... N72-27171*#

DLR-FB-72-18 ..... N72-27826 #

DME-MP-56 ..... N72-27543 #

DMS-DR-1174-VOL-1-PT-A ..... N72-27924*#
DMS-DR-1174-VOL-1-PT-B ..... N72-27925*#
DMS-DR-1174-VOL-2-PT-B ..... N72-27926*#
DMS-DR-1174-VOL-3 ..... N72-27927*#
DMS-DR-1174-VOL-4 ..... N72-27928*#
DMS-DR-1174-VOL-5 ..... N72-27929*#
DMS-DR-1174-VOL-6 ..... N72-27930*#
DMS-DR-1232 ..... N72-27923*#
DMS-DR-1266 ..... N72-27935*#

DNA-2836F ..... N72-27478 #

DREV-666/72 ..... N72-27982 #

D210-10273-1 ..... N72-27069 #

E-6507 ..... N72-27528*#
E-6666 ..... N72-27720*#
E-6760 ..... N72-27573*#
E-6786 ..... N72-27965*#
E-6833 ..... N72-27014*#
E-6897 ..... N72-27150*#
E-6901 ..... N72-27817*#
E-6942 ..... N72-27721*#
E-6955 ..... N72-27291*#
E-6958 ..... N72-27737*#
E-6975 ..... N72-27012*#
E-6985 ..... N72-27816*#
E-6995 ..... N72-27574*#
E-7000 ..... N72-27723*#
E-7005 ..... N72-27722*#
E-7010 ..... N72-27529*#
E-7012 ..... N72-27824*#
E-7023 ..... N72-27966*#
E-7028 ..... N72-27029*#
E-7036 ..... N72-27177*#
E-7038 ..... N72-27030*#
E-7048 ..... N72-27825*#

ECOM-0083-13 ..... N72-27668 #
ECOM-3467 ..... N72-27783 #
ECOM-3528 ..... N72-27073 #
ECOM-3531 ..... N72-27071 #
ECOM-3539 ..... N72-27072 #
ECOM-5411 ..... N72-27666 #
ECOM-5416 ..... N72-27282 #
ECOM-5417 ..... N72-27403 #
ECOM-5420 ..... N72-27042 #

ELR-3052 ..... N72-27661 #
ELR-4187 ..... N72-27284 #

ENVPREDRSCHFAC-TECH-PAPER-1-72 ..... N72-27667 #

EPIC-IR-74-REV ..... N72-27037 #

EPIC-S-15 ..... N72-27799 #

EPIC-SB-3 ..... N72-27742 #

ERDE-TR-44-PT-1 ..... N72-27602 #

ESD-TR-72-30 ..... N72-27193 #
ESD-TR-72-34 ..... N72-27258 #

ESRO-CR-(P)-76 ..... N72-27625 #

ESRO-SN-113 ..... N72-27383 #
ESRO-SN-115-ESTEC ..... N72-27531 #
ESRO-SN-117 ..... N72-27382 #

ESRO-TN-153-ESTEC ..... N72-27276 #

FAA-AM-72-12 ..... N72-27080 #
FAA-AM-72-15 ..... N72-27011 #
FAA-AM-72-21 ..... N72-27105 #

FAA-NA-72-14 ..... N72-27694 #
FAA-NA-72-36 ..... N72-27700 #
FAA-NA-72-57 ..... N72-27702 #

FAA-RD-70-60 ..... N72-27709 #
FAA-RD-71-31 ..... N72-27085 #
FAA-RD-71-83 ..... N72-27050 #
FAA-RD-71-113 ..... N72-27710 #
FAA-RD-72-50 ..... N72-27694 #
FAA-RD-72-54 ..... N72-27700 #

FB-93 ..... N72-27325 #

FEL-358.37 ..... N72-27540 #

FILE-1-0013 ..... N72-27049 #

FRA-RT-72-28 ..... N72-27238 #

FSTC-HT-23-1238-72 ..... N72-27988 #
FSTC-HT-23-1240-72 ..... N72-27990 #
FSTC-HT-23-1601-72 ..... N72-27991 #

FTD-HC-23-320-71 ..... N72-27329 #
FTD-HC-23-1736-71 ..... N72-27607 #

FTD-HT-23-284-71 ..... N72-27939 #
FTD-HT-23-709-71 ..... N72-27938 #
FTD-HT-23-711-71 ..... N72-27191 #
FTD-HT-23-888-71 ..... N72-27533 #
FTD-HT-23-1062-71 ..... N72-27581 #
FTD-HT-23-1063-71 ..... N72-27582 #
FTD-HT-23-1095-71 ..... N72-27534 #
FTD-HT-23-1173-71 ..... N72-27780 #
FTD-HT-23-1200-71 ..... N72-27658 #
FTD-HT-23-1206-71 ..... N72-27586 #
FTD-HT-23-1212-71 ..... N72-27665 #
FTD-HT-23-1215-71 ..... N72-27744 #
FTD-HT-23-1231-71 ..... N72-27537 #
FTD-HT-23-1233-71 ..... N72-27330 #
FTD-HT-23-1239-71 ..... N72-27535 #
FTD-HT-23-1240-71 ..... N72-27803 #
FTD-HT-23-1241-71 ..... N72-27970 #
FTD-HT-23-1247-71 ..... N72-27333 #
FTD-HT-23-1266-71 ..... N72-27743 #
FTD-HT-23-1300-71 ..... N72-27328 #
FTD-HT-23-1338-71 ..... N72-27657 #
FTD-HT-23-1352-71 ..... N72-27281 #
FTD-HT-23-1522-71 ..... N72-27536 #
FTD-HT-23-1570-71 ..... N72-27068 #

FTD-MT-24-79-71 ..... N72-27605 #
FTD-MT-24-101-71 ..... N72-27538 #
FTD-MT-24-104-71 ..... N72-27237 #
FTD-MT-24-113-71 ..... N72-27161 #

FTD-MT-24-115-71 ..... N72-27583 #
FTD-MT-24-122-71 ..... N72-27805 #
FTD-MT-24-941-71 ..... N72-27587 #
FTD-MT-24-1030-71 ..... N72-27781 #
FTD-MT-24-1107-71 ..... N72-27331 #
FTD-MT-24-1138-71 ..... N72-27539 #
FTD-MT-24-1595-71 ..... N72-27802 #
FTD-MT-24-1603-71 ..... N72-27588 #
FTD-MT-24-1616-71 ..... N72-27474 #
FTD-MT-24-1863-71 ..... N72-27585 #

FZK-378 ..... N72-27717*#
FZK-380 ..... N72-27718*#

F2027-IR1 ..... N72-27713 #

G-1034 ..... N72-27732*#

GAPD-21192-FR ..... N72-27045 #

GDCA-DDA72-009 ..... N72-27919*#

GE-R72AEG165 ..... N72-27290*#

H-REPT-92-1071 ..... N72-27974 #

H-663 ..... N72-27013*#

HASL-250 ..... N72-27724 #

HDL-TM-71-44 ..... N72-27194 #

HDL-TR-1578 ..... N72-27242 #

HRC-TR-S-209 ..... N72-27050 #

IFA-CP-226 ..... N72-27642*#

IIHR-136 ..... N72-27655 #

IIR-70-AL-145 ..... N72-27220*#
IIR-70-AL-146 ..... N72-27235*#
IIR-70-AL-147 ..... N72-27434*#
IIR-70-LF-157 ..... N72-27706*#

IITRI-C6239-A005-1 ..... N72-27162 #

ILL-(TH)-72-7 ..... N72-27758 #

IR-USGS-NASA-238 ..... N72-27149*#

IR-4 ..... N72-27040 #

ISL-14/71 ..... N72-27324 #
ISL-16/71 ..... N72-27323 #

ISO-5166-72 ..... N72-27792*#

ISR-2 ..... N72-27741 #

IWL-2757-229 ..... N72-27387 #

JPL-TM-33-543 ..... N72-27850*#

JPL-TR-32-1556 ..... N72-27964*#
JPL-TR-32-1559 ..... N72-27251*#

JPRS-56289 ..... N72-27733 #
JPRS-56370 ..... N72-27210 #
JPRS-56371 ..... N72-27254 #
JPRS-56385 ..... N72-27175 #
JPRS-56387 ..... N72-27695 #
JPRS-56398 ..... N72-27884 #
JPRS-56406 ..... N72-27578 #
JPRS-56424 ..... N72-27003 #
JPRS-56426 ..... N72-27981 #
JPRS-56437 ..... N72-27322 #
JPRS-56444 ..... N72-27890 #
JPRS-56460 ..... N72-27895 #
JPRS-56463 ..... N72-27705 #
JPRS-56464 ..... N72-27881 #
JPRS-56465 ..... N72-27179 #
JPRS-56487 ..... N72-27704 #

J0012-FR ..... N72-27608 #

KGO-727 ..... N72-27384 #

KHB-8410.X ..... N72-27918*#

KSC-GP-958 ..... N72-27261*+

KSC-K-V-0513-2-VOL-2-REV-3 ..... N72-27917*#

KSC-TM4-275-MI ..... N72-27916*#

KSC-TR-1144 ..... N72-27915*#

L-8139 ..... N72-26997*#
L-8215 ..... N72-27312*#
L-8219 ..... N72-27033*#
L-8278 ..... N72-27002*#
L-8283 ..... N72-27010*#
L-8306 ..... N72-27311*#

LC-26-27766 ..... N72-27975 #
LC-71-189484 ..... N72-27799 #
LC-73-608985 ..... N72-27525 #
LC-74-181492 ..... N72-27356*#

LCC-68-60042 ..... N72-27523 #
LCC-68-60042 ..... N72-27524 #

LMSC-D157926 ..... N72-27913*#
LMSC-D157926-APP ..... N72-27914*#

LMSC-M-JY-71-8 ..... N72-27552 #

LMSC/D156879 ..... N72-27173*#

LRBA-E204-PV-5 ..... N72-27471 #

M-188 ..... N72-27001*#

MCR-72-41-VOL-1 ..... N72-27911*#
MCR-72-91-VOL-1 ..... N72-27933*#
MCR-72-91-VOL-2 ..... N72-27934*#
MCR-72-108 ..... N72-27846*#

MDC-G2089 ..... N72-27604 #
MDC-G2727 ..... N72-27912*#

MDC-J5317 ..... N72-27040 #

ME-TR-286 ..... N72-27084*#

MG/35/71 ..... N72-27545 #
MG/58/71 ..... N72-27544 #

ML-1954 ..... N72-27553 #

MPI-PAE-EXTRATERR-59 ..... N72-27896 #

MSC-05801 ..... N72-27349*#

MSFC-DPD-235 ..... N72-27912*#

MTR-5094 ..... N72-27238 #

M70-43/5 ..... N72-27339
M70-43/8 ..... N72-27415

NA-72-232 ..... N72-27589 #
NA-72-273 ..... N72-27593 #

NADC-CS-7111 ..... N72-27278 #
NADC-CS-7114 ..... N72-27098 #

NADC-MA-7164 ..... N72-27606 #
NADC-MA-7171 ..... N72-27584 #

NADC-ST-7111 ..... N72-27036 #

NADC-72022-VT ..... N72-27038 #

NAFI-TR-1771 ..... N72-27222 #

NAL-TR-245 ..... N72-27026 #
NAL-TR-248 ..... N72-27317 #
NAL-TR-251 ..... N72-27892 #
NAL-TR-252T ..... N72-27318 #
NAL-TR-254 ..... N72-27000 #
NAL-TR-256 ..... N72-27028 #
NAL-TR-257 ..... N72-27953 #
NAL-TR-258 ..... N72-27931 #
NAL-TR-259 ..... N72-27429 #
NAL-TR-262 ..... N72-27952 #
NAL-TR-264 ..... N72-27932 #

NAL-TR-265 ..... N72-27428 #
NAL-TR-266 ..... N72-26998 #
NAL-TR-268T ..... N72-26999 #
NAL-TR-269T ..... N72-27619 #
NAL-TR-271 ..... N72-27949 #
NAL-TR-272 ..... N72-27823 #
NAL-TR-273 ..... N72-27822 #
NAL-TR-274 ..... N72-27948 #
NAL-TR-276 ..... N72-27027 #
NAL-TR-278T ..... N72-27316 #
NAL-TR-279 ..... N72-27950 #

NASA-CASE-ARC-10160-1 ..... N72-27728*
NASA-CASE-ARC-10516-1 ..... N72-27739*#
NASA-CASE-ARC-10596-1 ..... N72-27233*#

NASA-CASE-ERC-10015-2 ..... N72-27246*

NASA-CASE-GSC-10344-1 ..... N72-27053*
NASA-CASE-GSC-11222-1 ..... N72-27548*#
NASA-CASE-GSC-11353-1 ..... N72-27736*#
NASA-CASE-GSC-11434-1 ..... N72-27430*#

NASA-CASE-HQN-10037-1 ..... N72-27424*#
NASA-CASE-HQN-10792-1 ..... N72-27230*#
NASA-CASE-HQN-10793-1 ..... N72-27230*#

NASA-CASE-KSC-10644 ..... N72-27227*
NASA-CASE-KSC-10729-1 ..... N72-27234*#
NASA-CASE-KSC-10730-1 ..... N72-27431*#

NASA-CASE-LAR-10362-1 ..... N72-27486*
NASA-CASE-LAR-10365-1 ..... N72-27102*
NASA-CASE-LAR-10416-1 ..... N72-27527*#
NASA-CASE-LAR-10426-1 ..... N72-27947*#
NASA-CASE-LAR-10550-1 ..... N72-27271*#
NASA-CASE-LAR-10642-1 ..... N72-27820*#
NASA-CASE-LAR-10717-1 ..... N72-27703*#
NASA-CASE-LAR-10730-1 ..... N72-27255*#
NASA-CASE-LAR-10800-1 ..... N72-27959*
NASA-CASE-LAR-10812-1 ..... N72-27272*#
NASA-CASE-LAR-10836-1 ..... N72-27784*
NASA-CASE-LAR-10868-1 ..... N72-27232*#

NASA-CASE-LEW-10330-1 ..... N72-27226*

NASA-CASE-MFS-20335-1 ..... N72-27421*#
NASA-CASE-MFS-20523 ..... N72-27412*
NASA-CASE-MFS-20620 ..... N72-27262*
NASA-CASE-MFS-21136-1 ..... N72-27731*#
NASA-CASE-MFS-21394-1 ..... N72-27310*#
NASA-CASE-MFS-21395-1 ..... N72-27425*#

NASA-CASE-MSC-12293-1 ..... N72-27411*
NASA-CASE-MSC-12396-1 ..... N72-27063*#
NASA-CASE-MSC-13648 ..... N72-27103*
NASA-CASE-MSC-14053-1 ..... N72-27215*#
NASA-CASE-MSC-14070-1 ..... N72-27178*#

NASA-CASE-NPO-10542 ..... N72-27228*
NASA-CASE-NPO-10721 ..... N72-27484*
NASA-CASE-NPO-10767-2 ..... N72-27151*#
NASA-CASE-NPO-10768-2 ..... N72-27144*
NASA-CASE-NPO-11147 ..... N72-27408*
NASA-CASE-NPO-11201 ..... N72-27409*
NASA-CASE-NPO-11941-1 ..... N72-27249*#

NASA-CASE-XLA-09843 ..... N72-27485*

NASA-CASE-XLE-05230 ..... N72-27410*
NASA-CASE-XLE-10326-4 ..... N72-27522*#

NASA-CR-1995 ..... N72-27054*#
NASA-CR-1996 ..... N72-27064*#
NASA-CR-1999 ..... N72-27819*#
NASA-CR-2042 ..... N72-27718*#
NASA-CR-2044 ..... N72-27945*#
NASA-CR-2045 ..... N72-27717*#
NASA-CR-2046 ..... N72-26996*#
NASA-CR-61386-APP-0 ..... N72-27680*#
NASA-CR-61386-APP-R ..... N72-27920*#
NASA-CR-72880 ..... N72-27818*#
NASA-CR-111866 ..... N72-27104*#
NASA-CR-112034-1 ..... N72-27922*#
NASA-CR-112077-1 ..... N72-27876*#
NASA-CR-112077-2 ..... N72-27877*#
NASA-CR-112077-3 ..... N72-27878*#
NASA-CR-112077-4 ..... N72-27879*#

NASA-CR-112102 ..... N72-27173*#
NASA-CR-114458 ..... N72-27032*#
NASA-CR-114475 ..... N72-27065*#
NASA-CR-114476 ..... N72-27066*#
NASA-CR-115643 ..... N72-27219*#
NASA-CR-115645 ..... N72-27218*#
NASA-CR-116777 ..... N72-27252*#
NASA-CR-116779 ..... N72-27253*#
NASA-CR-120008-VOL-1-PT-A ..... N72-27924*#
NASA-CR-120008-VOL-1-PT-B ..... N72-27925*#
NASA-CR-120061 ..... N72-27926*#
NASA-CR-120062 ..... N72-27927*#
NASA-CR-120063 ..... N72-27928*#
NASA-CR-120064 ..... N72-27929*#
NASA-CR-120065 ..... N72-27930*#
NASA-CR-120072 ..... N72-27935*#
NASA-CR-120883 ..... N72-27290*#
NASA-CR-120940 ..... N72-27575*#
NASA-CR-120949 ..... N72-27792*#
NASA-CR-122432 ..... N72-27701*#
NASA-CR-122433 ..... N72-27231*#
NASA-CR-122435 ..... N72-27168*#
NASA-CR-122436 ..... N72-27933*#
NASA-CR-122437 ..... N72-27646*#
NASA-CR-122438 ..... N72-27174*#
NASA-CR-122439 ..... N72-27934*#
NASA-CR-122441 ..... N72-27550*#
NASA-CR-122447 ..... N72-27347*#
NASA-CR-123710 ..... N72-27673*#
NASA-CR-123712 ..... N72-27911*#
NASA-CR-123714 ..... N72-27515*#
NASA-CR-123719 ..... N72-27912*#
NASA-CR-123722 ..... N72-27923*#
NASA-CR-123724 ..... N72-27526*#
NASA-CR-123733 ..... N72-27919*#
NASA-CR-123799 ..... N72-27204*#
NASA-CR-127117 ..... N72-27913*#
NASA-CR-127118 ..... N72-27914*#
NASA-CR-127122 ..... N72-27176*#
NASA-CR-127124 ..... N72-27850*#
NASA-CR-127234 ..... N72-27055*#
NASA-CR-127250 ..... N72-27434*#
NASA-CR-127251 ..... N72-27235*#
NASA-CR-127252 ..... N72-27220*#
NASA-CR-127253 ..... N72-27706*#
NASA-CR-127254 ..... N72-27350*#
NASA-CR-127255 ..... N72-27964*#
NASA-CR-127256 ..... N72-27205*#
NASA-CR-127257 ..... N72-27149*#
NASA-CR-127258 ..... N72-27755*#
NASA-CR-127259 ..... N72-27356*#
NASA-CR-127260 ..... N72-27756*#
NASA-CR-127261 ..... N72-27757*#
NASA-CR-127262 ..... N72-27078*#
NASA-CR-127263 ..... N72-27206*#
NASA-CR-127264 ..... N72-27849*#
NASA-CR-127265 ..... N72-27154*#
NASA-CR-127266 ..... N72-27208*#
NASA-CR-127267 ..... N72-27847*#
NASA-CR-127268 ..... N72-27679*#
NASA-CR-127269 ..... N72-27361*#
NASA-CR-127270 ..... N72-27345*#
NASA-CR-127271 ..... N72-27167*#
NASA-CR-127272 ..... N72-27771*#
NASA-CR-127273 ..... N72-27848*#
NASA-CR-127274 ..... N72-27831*#
NASA-CR-127275 ..... N72-27730*#
NASA-CR-127276 ..... N72-27250*#
NASA-CR-127277 ..... N72-27358*#
NASA-CR-127387 ..... N72-27770*#
NASA-CR-127416 ..... N72-27821*#
NASA-CR-127417 ..... N72-27985*#
NASA-CR-127418 ..... N72-27251*#
NASA-CR-127419 ..... N72-27761*#
NASA-CR-127420 ..... N72-27375*#
NASA-CR-127421 ..... N72-27376*#
NASA-CR-127422 ..... N72-27370*#
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NASA-TR-R-385 ..... N72-27311*#
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NASA-TT-F-14413 ..... N72-27751*#

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NBS-SP-300-VOL-5 ..... N72-27523 #
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NBS-SP-358 ..... N72-27975 #

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NLL-CE-TRANS-5594-(9022.09) N72-27560
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NLL-CE-TRANS-5885-(9022.09) N72-27715

NLL-DRIC-TRANS-2644-(3623.66) N72-27547

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NLL-RTS-6898 ..... N72-27075
NLL-RTS-6963 ..... N72-27558
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NLL-SMRE-TRANS-5691-(8313.4) N72-27414

NLL-T-518-(9022.305) N72-27565
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NLL-TRANS-746-1194-(9022.401) N72-27789
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NOAA-TM-NESS-36 ..... N72-27641 #
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NOLTR-72-38 ..... N72-27326 #

NOR-71-127 ..... N72-27039 #

NOTA-INTERNA-356 ..... N72-27769 #
NOTA-INTERNA-361 ..... N72-27624 #

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NPS-61MD72021A ..... N72-27388 #

NRC-TT-1551 ..... N72-27083 #
NRC-TT-1552 ..... N72-27134 #

NRC-12433 ..... N72-27543 #

NRL-MR-2398 ..... N72-27726 #

NRL-TRANS-1238 ..... N72-27160 #

NSF-72-301 ..... N72-27978 #

NSRDC-3789 ..... N72-27092 #

NTSB-AAR-72-2 ..... N72-27049 #
NTSB-AAR-72-16 ..... N72-27025 #

NUSC-TM-PA4-234-71 ..... N72-27740 #

NWC-TP-5294 ..... N72-27654 #

NWL-TR-2671 ..... N72-27245 #

OAP-284 ..... N72-27358*#

OMB-04-S71002 ..... N72-27280 #

ONR-29 ..... N72-27067 #

ONRL-C-4-72 ..... N72-27808 #

OSU-WP-71-I-13 ..... N72-27668 #

OT/ITSTM-73 ..... N72-27202 #

P-4791 ..... N72-27214 #
P-4794 ..... N72-27984 #
P-4804 ..... N72-27738 #
P-4806 ..... N72-27983 #
P-4809 ..... N72-27256 #
P-4812 ..... N72-27157 #
P-4817 ..... N72-27213 #
P-4825 ..... N72-27212 #

PB-202052-F N72-27266*
PB-204025-F ..... N72-27284 #
PB-207208 ..... N72-27240 #
PB-207327 ..... N72-27238 #
PB-207332-F N72-27267*
PB-207377 ..... N72-27241 #
PB-207385 ..... N72-27401 #
PB-207425 ..... N72-27545 #
PB-207429 ..... N72-27544 #
PB-207529 ..... N72-27280 #
PB-207539-F ..... N72-27661 #
PB-207594 ..... N72-27391 #
PB-207595 ..... N72-27390 #
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PB-207976 ..... N72-27670 #
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PPG-100 ..... N72-27770*#
PPG-119 ..... N72-27347*#

PR-45 ..... N72-27730*#
PR-80 ..... N72-27617*#

PUBL-70-10 ..... N72-27980 #
PUBL-884 ..... N72-27600 #
PUBL-1007 ..... N72-27167*#

P72-24 ..... N72-27515*#

QPR-2 ..... N72-27546 #
QPR-4 ..... N72-27259 #

QPR-28 ..... N72-27077*#

QR-1-PT-1 ..... N72-27633
QR-5 ..... N72-27257 #

R-793-ARPA ..... N72-27779 #
R-916-1-NSF ..... N72-27621 #
R-926-NSF ..... N72-27618 #

RADC-TR-71-300-VOL-1-PT-1 ..... N72-27196 #
RADC-TR-71-300-VOL-1-PT-2 ..... N72-27197 #
RADC-TR-71-300-VOL-2-PT-1 ..... N72-27198 #
RADC-TR-71-300-VOL-2-PT-2 ..... N72-27199 #
RADC-TR-71-300-VOL-2-PT-3 ..... N72-27200 #
RADC-TR-71-307 ..... N72-27259 #
RADC-TR-72-17 ..... N72-27257 #

RAE-TR-71150 ..... N72-27897 #
RAE-TR-71171 ..... N72-27900 #
RAE-TR-71223 ..... N72-27158 #
RAE-TR-71224 ..... N72-27159 #
RAE-TR-72003 ..... N72-27899 #
RAE-TR-72004 ..... N72-27898 #

RE-TR-72-2 ..... N72-27195 #

RE-422 ..... N72-27051 #

REPT-3 ..... N72-27901 #
REPT-3SR-1034 ..... N72-27669 #
REPT-4 ..... N72-27396 #
REPT-5 ..... N72-27516*#
REPT-6-71 ..... N72-27188 #
REPT-7-71 ..... N72-27189 #
REPT-9 ..... N72-27367 #
REPT-10-71 ..... N72-27283 #
REPT-18 ..... N72-27203
REPT-57 ..... N72-27532 #
REPT-62 ..... N72-27708 #
REPT-64 ..... N72-27034 #
REPT-71-7300-3.1-VOL-3 ..... N72-27054*#
REPT-71-7300-3.2-VOL-4 ..... N72-27064*#
REPT-72-0522 ..... N72-27526*#
REPT-127 ..... N72-27221 #
REPT-127 ..... N72-27636
REPT-128 ..... N72-27635
REPT-130 ..... N72-27181 #
REPT-150 ..... N72-27269
REPT-154 ..... N72-27182 #
REPT-162 ..... N72-27183 #
REPT-165 ..... N72-27185 #
REPT-173 ..... N72-27184 #
REPT-175 ..... N72-27186 #
REPT-177 ..... N72-27187 #
REPT-202-105 ..... N72-27361*#
REPT-530-72-01 ..... N72-27048 #
REPT-1500-71-43 ..... N72-27044 #
REPT-2437 ..... N72-27418
REPT-86185 ..... N72-27218*#
REPT-86185-D ..... N72-27219*#
REPT-010342-1-F ..... N72-27201 #

RG-TR-71-19 ..... N72-27223 #

RIFP-148 ..... N72-27760 #

RL-TR-71-15 ..... N72-27260 #

RM-548 ..... N72-27838 #

ROE-STS-123 ..... N72-27936 #
ROE-STS-124 ..... N72-27937 #

RPE-TR-71/4 ..... N72-27277 #

RR-18 ..... N72-27670 #
RR-22 ..... N72-27671 #
RR-725 ..... N72-27791 #

RTRC-A183 ..... N72-27374 #
RTRC-A184 ..... N72-27373 #

R71AEG195 ..... N72-27818*#

S-REPT-92-820 ..... N72-27973 #

S-23 ..... N72-27673*#

SAAB-TN-68 ..... N72-27472 #

SAM-TR-71-12 ..... N72-27086 #
SAM-TR-71-46 ..... N72-27192 #
SAM-TR-72-1 ..... N72-27091 #
SAM-TR-72-5 ..... N72-27087 #

SAMSO-TR-71-237 ..... N72-27940 #
SAMSO-TR-72-26 ..... N72-27610 #
SAMSO-TR-72-36 ..... N72-27395 #
SAMSO-TR-72-38 ..... N72-27902 #
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SAMSO-TR-72-58 ..... N72-27405 #
SAMSO-TR-72-62 ..... N72-27712 #
SAMSO-TR-72-63 ..... N72-27163 #
SAMSO-TR-72-64 ..... N72-27609 #
SAMSO-TR-72-66 ..... N72-27479 #
SAMSO-TR-72-67 ..... N72-27746 #

SAO-SPECIAL-REPT-342 ..... N72-27361*#
SAO-SPECIAL-REPT-343 ..... N72-27363*#

SASR-4 ..... N72-27553 #

SATR-3 ..... N72-27580 #

SBN-11-470151-2 ..... N72-26993
SBN-11-470152-0 ..... N72-26994
SBN-11-470153-9 ..... N72-26995

SC523.1(ER) ..... N72-27611 #

SD-70-456 ..... N72-27104*#

SDL-269 ..... N72-27393 #
SDL-276 ..... N72-27394 #

SDSU-RSI-72-11 ..... N72-27368 #

SI-5 ..... N72-27381 #

SIO-REF-72-2 ..... N72-27404 #

SKF-AL72P001 ..... N72-27546 #

SR-3 ..... N72-27801 #
SR-15 ..... N72-27190 #
SR-17 ..... N72-27402 #

SRRC-CR-70-9 ..... N72-27250*#

SU-IPR-466 ..... N72-27370*#
SU-IPR-469 ..... N72-27834*#

SWERR-TR-72-6 ..... N72-27591 #
SWERR-TR-72-11 ..... N72-27611 #

T-MITT-4/71 ..... N72-27579 #

TA/OST-AN-66-3-1 ..... N72-27401 #

TAE-146 ..... N72-27320 #
TAE-147 ..... N72-27176*#
TAE-148 ..... N72-27951 #

TB-88 ..... N72-27035 #

TETRAT-P-72-155-3 ..... N72-27165 #

TN-BN-737 ..... N72-27346*#

TN-41 ..... N72-27645*#
TN-42 ..... N72-27643 #
TN-43 ..... N72-27644 #
TN-1972-6 ..... N72-27193 #

TOPOCOM-TR-1-10 ..... N72-27541 #

TR-8 ..... N72-27589 #
TR-9 ..... N72-27593 #
TR-32 ..... N72-27628 #
TR-45-1 ..... N72-27345*#
TR-45-2 ..... N72-27345*#
TR-47 ..... N72-27369*#
TR-72-084 ..... N72-27768 #
TR-72-088 ..... N72-27766 #
TR-72-101 ..... N72-27623 #
TR-72-111 ..... N72-27622 #
TR-72-122 ..... N72-27765 #
TR-72-129 ..... N72-27767 #

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US-PATENT-CLASS-313-336 ..... N72-27246*
US-PATENT-CLASS-313-351 ..... N72-27246*
US-PATENT-CLASS-315-36 ..... N72-27246*
US-PATENT-CLASS-315-151 ..... N72-27411*
US-PATENT-CLASS-315-156 ..... N72-27411*
US-PATENT-CLASS-315-158 ..... N72-27411*
US-PATENT-CLASS-315-297 ..... N72-27411*
US-PATENT-CLASS-315-307 ..... N72-27411*
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US-PATENT-CLASS-331-44 ..... N72-27408*
US-PATENT-CLASS-336-60 ..... N72-27226*
US-PATENT-CLASS-336-198 ..... N72-27226*
US-PATENT-CLASS-336-220 ..... N72-27226*
US-PATENT-CLASS-340-240 ..... N72-27227*
US-PATENT-CLASS-350-138 ..... N72-27728*
US-PATENT-CLASS-350-147 ..... N72-27409*
US-PATENT-CLASS-350-161 ..... N72-27784*
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US-PATENT-CLASS-356-152 ..... N72-27409*

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US-PATENT-3,668,956 ..... N72-27485*
US-PATENT-3,669,110 ..... N72-27103*
US-PATENT-3,669,393 ..... N72-27484*
US-PATENT-3,670,097 ..... N72-27728*
US-PATENT-3,670,168 ..... N72-27409*
US-PATENT-3,670,202 ..... N72-27411*
US-PATENT-3,670,241 ..... N72-27408*
US-PATENT-3,670,559 ..... N72-27959*
US-PATENT-3,670,563 ..... N72-27412*
US-PATENT-3,670,564 ..... N72-27262*
US-PATENT-3,670,890 ..... N72-27102*
US-PATENT-3,671,105 ..... N72-27784*
US-PATENT-3,671,329 ..... N72-27410*
US-PATENT-3,671,497 ..... N72-27144*
US-PATENT-3,671,798 ..... N72-27246*
US-PATENT-3,672,999 ..... N72-27053*
US-PATENT-3,673,424 ..... N72-27227*
US-PATENT-3,673,440 ..... N72-27228*

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X-320-71-518 ..... N72-27734*#
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X-621-72-185 ..... N72-27364*#
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X-625-72-187 ..... N72-27888*#
X-641-72-198 ..... N72-27880*#
X-644-72-157 ..... N72-27886*#
X-645-72-201 ..... N72-27432*#
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Significant Accomplishments in Sciences: Goddard Space Flight Center, 1970 (NASA SP–286)

This is the record of Goddard Space Flight Center's annual progress report to the center director from the scientists and engineers. The internal symposium was held January 14, 1971. *Paperbound.* 256 pp. For sale by the National Technical Information Service, Springfield, Va. 22151, for $3.00.

Atlas and Gazetteer of the Near Side of the Moon (NASA SP–241)

BY GARY L. GUTSCHEWSKI, DANNY C. KINSLER, AND EWEN WHITAKER

This large-format (10¼x13¾) atlas and gazetteer from the Manned Spacecraft Center is a photographic and tabular compilation of named lunar features on the near side of the Moon. The names have been annotated on the photographs, which are accompanied by locational data regarding the named features.

Five indices comprising the gazetteer are provided for appropriate cross-referencing of the high-resolution Orbiter IV photography and the medium-resolution photography obtained from the other Orbiter missions. *Clothbound.* 544 pp. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $15.00.

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19

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